

# PATENT ABSTRACTS OF JAPAN

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(30)Priority

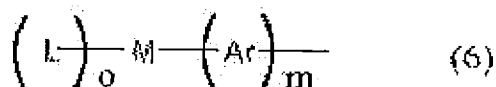
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(54) POLYMERIC LIGHT EMITTER AND POLYMERIC LIGHT-EMITTING DEVICE USING THE SAME

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a new light emitter having a triplet light-emitting complex structure in the molecule and capable of forming a light-emitting layer by coating, a method for producing the light emitter, and a light-emitting device obtained by using the light emitter.

SOLUTION: The polymeric light emitter has a polystyrene-reduced number-average molecular weight of 103 to 108 and has a metal complex structure exhibiting light emission from the excited triplet state in the main chain or in the side chain. The metal complex structure exhibiting light emission from the excited triplet state has a structure expressed by formula (6) (M is an atom having an atomic number of  $\geq 50$  and a metal capable of causing the interstate crossing between the singlet state and the triplet state by the spin-orbit interaction in the complex; Ar is a ligand which bonds M with at least one of nitrogen atom, oxygen atom, carbon atom, sulfur atom or phosphorus atom; and L is hydrogen atom, alkyl group, aryl group, heterocyclic ligand or the like).



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1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. \*\*\*\* shows the word which can not be translated.
3. In the drawings, any words are not translated.

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CLAIMS

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[Claim(s)]

[Claim 1]

A polymers photogen in which a number average molecular weight of polystyrene conversion is a polymers photogen which are  $10^3 - 10^8$ , and this photogen is characterized by having the metal complex structure which shows luminescence from 3-fold paragraph excitation state in the main chain or side chain.

[Claim 2]

The polymers photogen according to claim 1 having the metal complex structure which shows luminescence from 3-fold paragraph excitation state in the main chain.

[Claim 3]

The polymers photogen according to claim 1 having the metal complex structure which shows luminescence from 3-fold paragraph excitation state in the side chain.

[Claim 4]

The polymers photogen according to claim 3 having the metal complex structure which shows luminescence from 3-fold paragraph excitation state in a connected conjugate side chain.

[Claim 5]

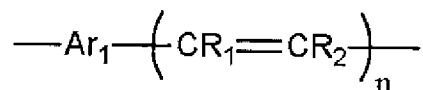
The polymers photogen according to claim 3, wherein an aromatic ring which has the metal complex structure which shows luminescence from 3-fold paragraph excitation state in a side chain, and is contained in at least one ligand of this metal complex structure, and an aromatic ring contained in a polymers main chain are connected by a carbon-carbon single bond.

[Claim 6]

A polymers photogen having the metal complex structure which a number average molecular weight of polystyrene conversion is a polymers photogen which are  $10^3 - 10^8$ , and shows luminescence from 3-fold paragraph excitation state in an end of the main chain.

[Claim 7]

The polymers photogen according to any one of claims 1 to 6 including a repeating unit shown by a general formula (1).



(1)

[Here, Ar<sub>1</sub> shows an allylene group or a divalent heterocycle group. R<sub>1</sub> and R<sub>2</sub> show a hydrogen atom, an alkyl group, an aryl group, a univalent heterocycle group, or a cyano group independently, respectively. n is 0 or 1. ]

[Claim 8]

The polymers photogen according to claim 7 including a repeating unit shown with a following



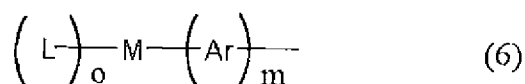
respectively, and when a or b is two or more, R<sub>18</sub> each or R<sub>19</sub> may be the same, or may differ.

[Claim 10]

As opposed to the sum total of a repeating unit shown by the general formula (1), (2), or (5), and a repeating unit which has the metal complex structure which shows luminescence from 3-fold paragraph excitation state, The polymers photogen according to any one of claims 7 to 9, wherein a repeating unit which has the metal complex structure which shows luminescence from 3-fold paragraph excitation state is less than more than 0.01 mol %10 mol %.

[Claim 11]

The polymers photogen according to any one of claims 1 to 10, wherein metal complex structure which shows luminescence from 3-fold paragraph excitation state is the structure shown with a following formula (6).



(Among a formula, M is a with an atomic numbers of 50 or more atom, and shows metal to which intersystem crossing between 1-fold paragraph state and 3-fold paragraph state can get up in this complex by a spin-orbit interaction.) Ar is a ligand combined with M or more by one of a nitrogen atom, an oxygen atom, a carbon atom, a sulfur atom, or the phosphorus atoms. L A hydrogen atom, an alkyl group, an aryl group, a heterocyclic ligand, a carboxyl group, A halogen atom, an amide group, an imido group, an alkoxy group, an alkyl sulfhydryl group, A carbonyl ligand, an alkene ligand, an alkyne ligand, an amine ligand, They are an imine ligand, a nitril ligand, an isonitrile ligand, a phosphine ligand, the phosphine oxide ligand, a phosphite ligand, an ether ligand, a sulfone ligand, a sulfoxide ligand, or a sulfide ligand. m shows an integer of 1-5. o shows an integer of 0-5.

[Claim 12]

The polymers photogen according to claim 11 including two or more sorts of metal complex structures shown by the above-mentioned formula (6).

[Claim 13]

The polymers photogen according to claim 11 or 12, wherein M is a rhenium atom, an osmium atom, an iridium atom, a platinum atom, the Kinbara child, a samarium atom, an europium atom, a gadolinium atom, a terbium atom, or a dysprosium atom.

[Claim 14]

The polymers photogen according to claim 13, wherein M is an iridium atom, a platinum atom, the Kinbara child, or an europium atom.

[Claim 15]

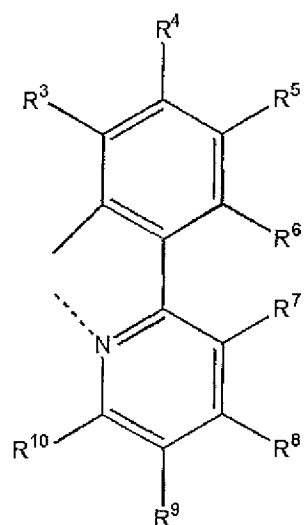
The polymers photogen according to any one of claims 11 to 14, wherein M combines with at least one carbon atom.

[Claim 16]

The polymers photogen according to any one of claims 11 to 15 which is 2 seat ligand in which Ar combines with M and forms a five-membered ring by any two atoms of a nitrogen atom, an oxygen atom, a carbon atom, a sulfur atom, or the phosphorus atom.

[Claim 17]

The polymers photogen according to any one of claims 11 to 16, wherein Ar is 2 seat ligand shown by a general formula (7).



(7)

[Independently  $R^3 - R^{10}$  among a formula, respectively A hydrogen atom, A halogen atom, an alkyl group, an alkenyl group, an aralkyl group, an arylthio group, An aryl alkenyl group, an annular alkenyl group, an alkoxy group, an aryloxy group, an alkyloxy carbonyl group, an aralkyloxy carbonyl group, an aryloxy carbonyl group, or an aryl group is shown. At least one of  $R^3 - R^{10}$  is bond groups with a polymer chain. ]

[Claim 18]

A monomer shown by  $X_1-A-X_2$  ( $X_1$  and  $X_2$  show a halogen atom, alkylsulfonyloxy, or an arylsulfonyloxy group here independently, respectively.)  $-A-$  shows a repeating unit which has the metal complex structure which shows luminescence from 3-fold paragraph excitation state - a monomer ( $X_3$  here) shown by  $X_3-D-X_4$  shows a halogen atom, an alkylsulfonyloxy group, or an arylsulfonyloxy group independently, respectively. D shows repeating units other than A. A manufacturing method of the polymers photogen according to any one of claims 7 to 17 making it react under existence of a Ni catalyst.

[Claim 19]

A monomer ( $Y_1$  and  $Y_2$  show a boric acid group or an ester-of-boric-acid group here independently, respectively.) shown by  $Y_1-A-Y_2$ , A monomer shown by  $Z_1-D-Z_2$  ( $Z_1$  and  $Z_2$  show a halogen atom, an alkylsulfonyloxy group, or an arylsulfonyloxy group.) D is the same as the above. A manufacturing method of the polymers photogen according to any one of claims 7 to 17 making it react under existence of a Pd catalyst.

[Claim 20]

A monomer shown by  $Y_3-D-Y_4$  ( $Y_3$  and  $Y_4$  are a boric acid group or an ester-of-boric-acid group independently here, respectively.) D is the same as the above -- a monomer ( $Z$  --) shown by  $Z_3-A-Z_4$  [ $_1$  and ]  $Z_2$  -- respectively -- independent -- a halogen atom, an alkylsulfonyloxy group, or an arylsulfonyloxy group -- being shown -- a manufacturing method of the polymers photogen according to any one of claims 7 to 17 making it react under existence of a Pd catalyst.

[Claim 21]

A polymers light emitting device, wherein it has a luminous layer in inter-electrode [ which consists of the anode and the negative pole ] at least and this luminous layer contains the polymers photogen according to any one of claims 1 to 17 in it.

[Claim 22]

A source of sheet-like light using the polymers light emitting device according to claim 21.

[Claim 23]

A segment display using the polymers light emitting device according to claim 21.

[Claim 24]

A dot matrix display using the polymers light emitting device according to claim 21.

[Claim 25]

A liquid crystal display using the polymers light emitting device according to claim 21 as a back light.

## DETAILED DESCRIPTION

[Detailed Description of the Invention]

[Field of the Invention]

[0001]

This invention can serve as a polymers photogen, its manufacturing method, and a monomer used for the manufacture.

The polymers light emitting device using a complex and this polymers photogen (\*\* called following polymers LED)

\*\*\*\*. It is related.

[Background of the Invention]

[0002]

As a luminescent material used for the luminous layer of a light emitting device, luminescence from 3-fold paragraph excitation state is shown.

The element which used the metal complex (it may be hereafter called 3-fold paragraph luminescence complex) for the luminous layer is \*\*.

It is known that optical efficiency is high.

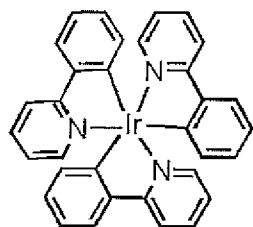
[0003]

Ir(ppy)<sub>3</sub> (A) which uses iridium as a central metal as a 3-fold paragraph luminescence complex, for example,

PtOEP which uses ppl.Phys.Lett., 75 and 4 (1999), and platinum as a central metal (Nature, 395,151)

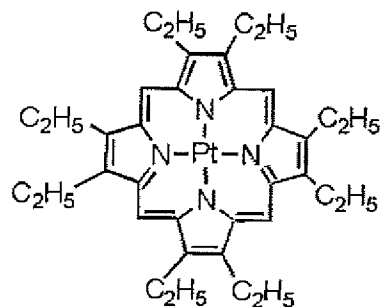
(1998) -- Eu(TTA)<sub>3</sub>phen (Jpn.J.Appl.Phys., 34, 1) which uses europium as a central metal 883 (1995) etc. -- it is known.

[0004]



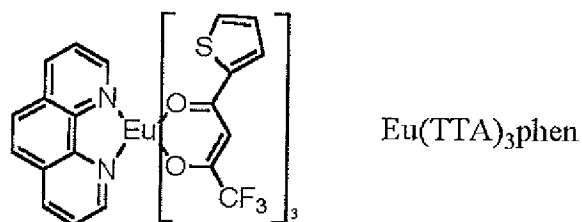
Ir(ppy)<sub>3</sub>

[0005]



PtOEP

[0006]



[Description of the Invention]

[Problem(s) to be Solved by the Invention]

[0007]

however, the above — forming a luminous layer using publicly known 3-fold paragraph luminescence complex

Usually, only methods, such as a vacuum deposition method, are used but forming a luminous layer by the applying method,

It was difficult.

[0008]

The purpose of this invention has 3-fold paragraph luminescence complex structure in intramolecular, and is a luminous layer by the applying method.

It can become a new photogen which can be formed, its manufacturing method, and a monomer used for the manufacture, and new

It is in providing a \*\*\*\* complex and this light emitting device that the luminescence object used.

[Means for Solving the Problem]

[0009]

This invention persons are polystyrene conversion as a result of inquiring wholeheartedly that an aforementioned problem should be solved.

A number average molecular weight is a polymers photogen which are  $10^3 - 10^8$ , and this photogen is the main chain.

Or polymers luminescence which has the metal complex structure which shows luminescence from 3-fold paragraph excitation state in a side chain

The body has 3-fold paragraph luminescence complex structure in intramolecular, and emits light by the applying method using this photogen.

It found out that a layer could be formed and resulted in this invention.

[Effect of the Invention]

[0010]

The polymers photogen of this invention has 3-fold paragraph luminescence complex structure in intramolecular, and is industrially simple.

It is a form about a luminous layer by the applying methods, such as a spin coat method, the ink jet method, and print processes.

It can accomplish. The polymers photogen of this invention contains 3-fold luminescence complex, and is high \*\*.

Optical efficiency can be shown. Therefore, the polymers photogen of this invention is the luminescence material of polymers LED.

It can use conveniently for a charge etc. It is this high part by the manufacturing method of this invention.

A child photogen can be manufactured easily. Polymers LED of this invention is a liquid crystal. The curved surface shape as the back light or the object for lighting of a display, a planate light source, SEGU

A MENTO type display device, the flat-panel display of a dot matrix, etc.

It can be preferably used for \*\*\*\*\*.

[Best Mode of Carrying Out the Invention]



[0011]

The number average molecular weights of polystyrene conversion are  $10^3 - 10^8$ , and the polymers photogen of this invention is \*\*.

It is a \*\*\*\*\* photogen and this photogen is from 3-fold paragraph excitation state to the main chain or side chain.

It is a polymers photogen which has the metal complex structure which shows \*\*\*\*\*.

[0012]

the metal complex structure which shows luminescence from 3-fold paragraph excitation state here -- 3-fold paragraph luminescence complex

The \*\*\*\*\* (ed) structure is said.

[0013]

In this invention, it is a parent of the metal complex structure which shows luminescence from 3-fold paragraph excitation state.

3-fold paragraph luminescence complex is explained.

3-fold paragraph luminescence complex is usually a heavy metal complex, for example, is \*\* about this complex to phosphorescence luminescence.

The complex which can carry out raw is said. However, the complex in which firefly luminescence is observed in addition to this phosphorescence luminescence

\*\*\*\* rare \*\*.

[0014]

As a 3-fold paragraph luminescence complex, it is used as an EL luminescence nature material of a low molecule system from the former.

Coming, such materials are Nature (1998), 395, 151, and Appl. Phys.

. Lett. (1999), 75 (1), 4, Proc. SPIE-Int. Soc. Opt. Eng. (2001), 4105 (Or)

ganic Light-Emitting Materials and Devices IV, 119, J. Am. Chem. Soc.,

(2001), 123, 4304, Appl. Phys. Lett. (1997), 71 (18), 2596, Syn. Met.,

(1998), 94 (1), 103, Syn. Met. (1999), 99 (2), 1361, and Adv. Mater. (1999),

It is indicated by 11 (10) and 852.

[0015]

As a central metal of 3-fold paragraph luminescence complex, it is a with an atomic numbers of 50 or more atom, and is usually this \*\*.

The body has a spin-orbit interaction and the intersystem crossing between 1-fold paragraph state and 3-fold paragraph state occurs.

It is metal in which it deals.

[0016]

As a central metal of 3-fold paragraph luminescence complex, they are a rhenium, iridium, and OSUMI, for example.

UMU, a scandium, yttrium, platinum, gold, and Euro of lanthanoides

PIUMU, a terbium, a thulium, a dysprosium, samarium, PURASEOJIU

MU, gadolinium, etc. are mentioned and iridium, platinum, gold, and europium are good \*\*.

Especially the iridium to spread is preferred.

[0017]

The ligand of 3-fold paragraph luminescence complex is usually an organic ligand, and the carbon number is usually 4-.

It is about 60.

[0018]

as the ligand of 3-fold paragraph luminescence complex -- an eight quinolinol -- and -- the -- it derives

the body, benzoquinolinol and its derivative, and 2-phenyl-pyridine -- and -- the

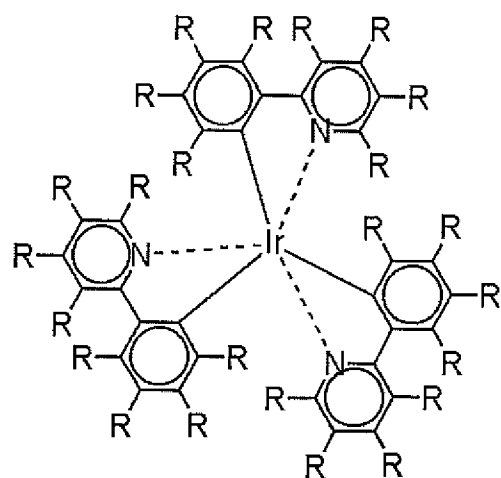
A derivative, 2-phenyl-benzothiazole and its derivative, 2-Feni Roubaix

NZOKISAZORU and its derivative, porphyrin, its derivative, etc. -- mentioning

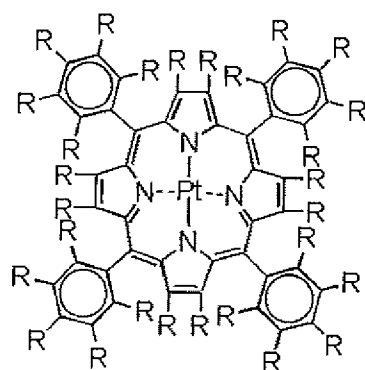
\*\*\*\*.

[0019]

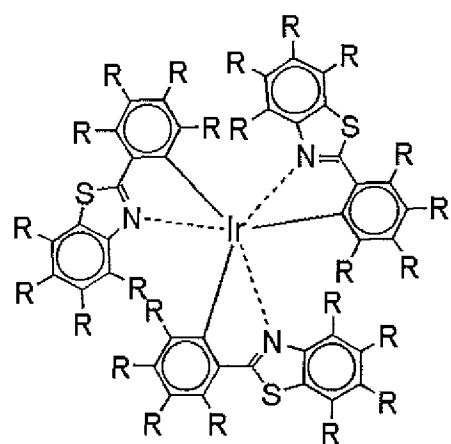
As a 3-fold paragon luminescence complex, the following are raised, for example.



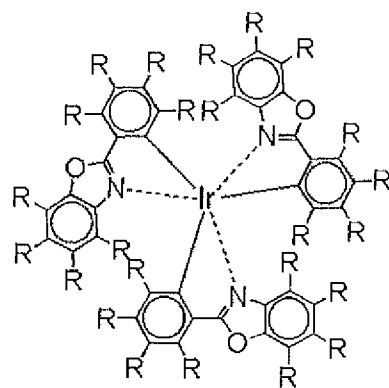
[0020]



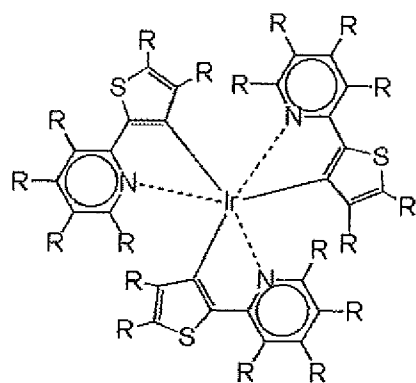
[0021]



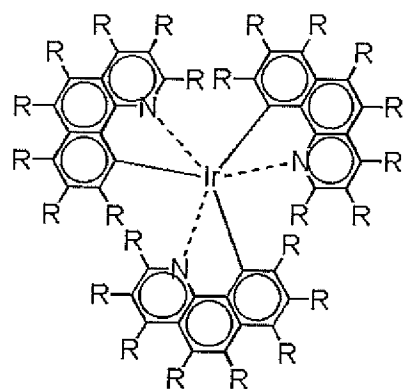
[0022]



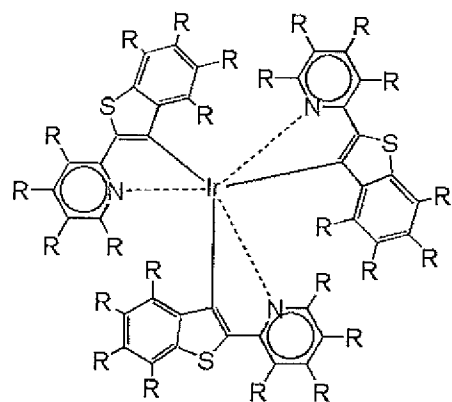
[0023]



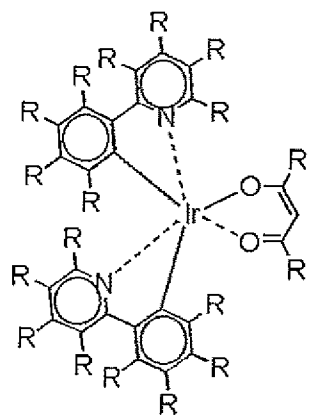
[0024]



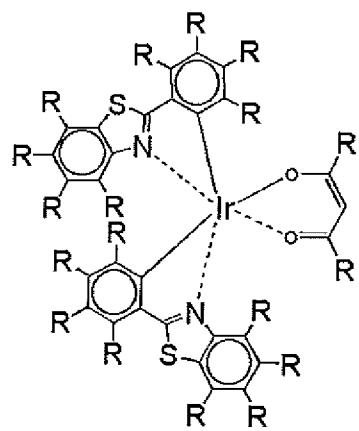
[0025]



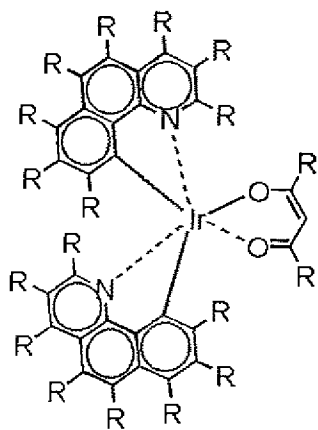
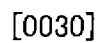
[0026]



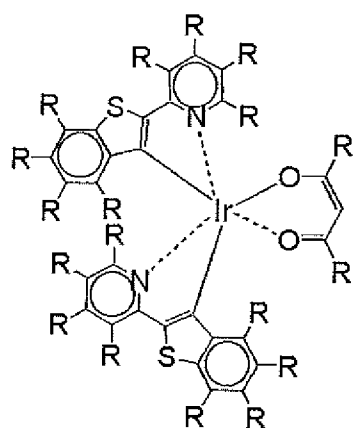
[0027]



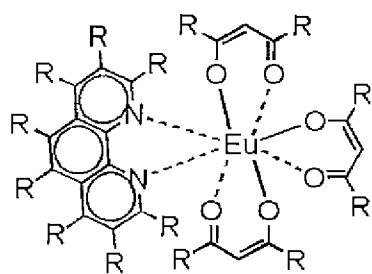
[0028]



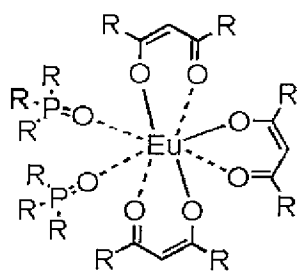
[0031]



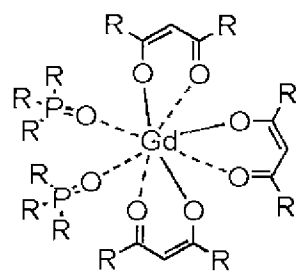
[0032]



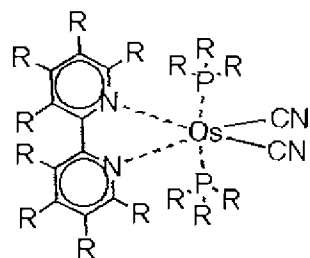
[0033]



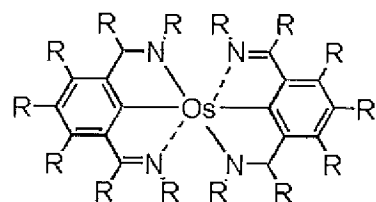
[0034]



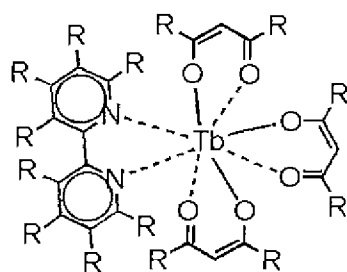
[0035]



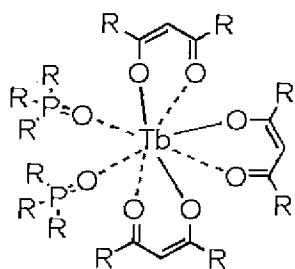
[0036]



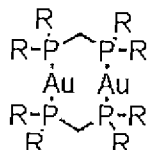
[0037]



[0038]



[0039]



[0040]

Here, R is a hydrogen atom, an alkyl group, an alkoxy group, and Ar independently, respectively. A thio group, an alkyl silyl group, an alkylamino group, an aryl group, an alkoxy group, an aryl alkenyl group, an alkenyl group, an arylamino group, a univalent heterocycle group, and a cyano group -- from

The basis chosen from a \*\* group is shown. In order to improve the solubility to a solvent, \*\* is preferred, and it is \*\*.

It is preferred that there is little symmetry of the shape of a repeating unit including \*\*\*\*\*, [0041]

A straight chain, branching, or annular any may be sufficient as an alkyl group, and carbon numbers are usually 1-2.

It is about zero and, specifically, they are a methyl group, an ethyl group, a propyl group, and i-propyl group.

A butyl group, i-butyl group, t-butyl group, a pentyl group, a hexyl group, cyclo

A hexyl group, a heptyl group, an octyl group, a 2-ethylhexyl group, a nonyl group, deci

A RU group, a 3,7-dimethyloctyl group, a lauryl group, etc. are mentioned, and it is a pentyl group,

A hexyl group, an octyl group, a 2-ethylhexyl group, a decyl group, 3,7-dimethyl

An octyl group is preferred.

[0042]

A straight chain, branching, or annular any may be sufficient as an alkoxy group, and a carbon number is usually 1-.

It is about 20 and, specifically, they are a methoxy group, an ethoxy basis, and a propyloxy group,

i-propyloxy group, a butoxy group, i-butoxy group, t-butoxy group, a pen

A hexyloxy group, a cyclohexyloxy group, a heptyloxy group

An octyloxy group, 2-ethylhexyloxy group, a nonyloxy group, DESHIRUO

A KISHI group, a 3,7-dimethyl octyloxy group, a lauryl oxy group, etc. are mentioned.

A pentyloxy group, a hexyloxy group, an octyloxy group, 2-ethyl HEKISHI

A RUOKISHI group, a decyloxy group, and a 3,7-dimethyl octyloxy group are preferred.

[0043]

A straight chain, branching, or annular any may be sufficient as an alkylthio group, and a carbon number is usually 1.

- it is about 20 -- concrete -- a methylthio group, an ethyl thio group, and a propyl thio group





A RUKOKISHI phenoxy group,  $C_1 - C_{12}$  alkyl phenoxy group are preferred.

[0048]

An arylated alkyl group is usually seven to about 60, and, specifically, a carbon number is FE.

\*\*\*\*-  $C_1 - C_{12}$  alkyl group,  $C_1 - C_{12}$  alkoxyphenyl  $C_1 - C_{12}$  ARUKI

A RU group,  $C_1 - C_{12}$  alkylphenyl  $C_1 - C_{12}$  alkyl group, 1-naphthyl  $C_1$

- $C_{12}$  alkyl group, a 2-naphthyl  $C_1 - C_{12}$  alkyl group, etc. are illustrated, and it is  $C_1 -$

$C_{12}$  alkoxyphenyl  $C_1 - C_{12}$  alkyl group,  $C_1 - C_{12}$  alkylphenyl

$C_1 - C_{12}$  alkyl group are preferred.

[0049]

An aryl alkoxy group is usually seven to about 60, and, specifically, a carbon number is FU.

\*\*\*\*\*-  $C_1 - C_{12}$  alkoxy group,  $C_1 - C_{12}$  alkoxyphenyl  $C_1 - C_{12}$  A

A RUKOKISHI group,  $C_1 - C_{12}$  alkylphenyl  $C_1 - C_{12}$  alkoxy group, 1-NAFUCHI

Roux  $C_1 - C_{12}$  alkoxy group, and 2-naphthyl  $C_1 - C_{12}$  alkoxy group, etc. illustrate.

It is carried out and they are  $C_1 - C_{12}$  alkoxyphenyl  $C_1 - C_{12}$  alkoxy group,  $C_1 - C_{12}$  Al.

Kill phenyl- $C_1 - C_{12}$  alkoxy group are preferred.

[0050]

An aryl alkenyl group is usually eight to about 60, and a carbon number is specifically cis. -

A phenyl alkenyl group, a trans-phenyl alkenyl group, the cis-tolyl alkenyl

A basis, a transu-tolyl alkenyl group, a cis-1-naphthyl alkenyl group, trans-1

- A naphthyl alkenyl group, a cis-2-naphthyl alkenyl group, trans-2-NAFUCHI

A RUARUKENIRU group etc. are illustrated.

[0051]

An aryl alkynyl group is usually eight to about 60, and a carbon number is specifically FE.

A nil alkynyl group, a tollyl alkynyl group, 1-naphthyl alkynyl group, 2-Naff

A chill alkynyl group etc. are illustrated.

[0052]

An arylamino group is usually six to about 60, and a carbon number is a phenylamino group,

A diphenylamino group,  $C_1 - C_{12}$  alkoxy phenylamino group, JI ( $C_1 - C_{12}$  A)

A RUKOKISHI phenylamino group, a JI ( $C_1 - C_{12}$  alkylphenyl) amino group, 1

- A naphthyl amino group, 2-naphthyl amino group, etc. are illustrated, and they are  $C_1 - C_{12}$

ARUKI.

A RUFE nil amino group and a JI ( $C_1 - C_{12}$  alkylphenyl) amino group are preferred.

[0053]

The remaining atom groups excluding one hydrogen atom from the heterocyclic compound with the univalent heterocycle group

It says, a carbon number is usually four to about 60, and, specifically, they are a thienyl group,  $C_1 - C_{12}$ .

An alkyl thienyl group, a pyrrolyl group, a furil group, a pyridyl group,  $C_1 - C_{12}$  alkyl

A pyridyl group etc. are illustrated and they are a thienyl group,  $C_1 - C_{12}$  alkyl thienyl group, and a pilus.

The Jill group,  $C_1 - C_{12}$  alkyl pyridyl group are preferred.

[0054]

In order to improve the solubility to the solvent of a polymers photogen among the examples of R, it is one or more.

It is preferred that the existing annular or long-chain alkyl chain is contained, and it is cyclopentyl.

They are a KISHIRU group, a pentyl group, a hexyl group, an octyl group, and 2-ECHIRUHEKI to

a basis and cyclo.

A silyl group, a decyl group, and a 3,7-dimethyloctyl group are illustrated. Two \*\*

A \*\* group is connected and the ring may be formed. Some carbon fields of an alkyl chain  
The child may be replaced by the basis containing a hetero atom, and considers it as those  
hetero atoms.

As for \*\*, an oxygen atom, a sulfur atom, a nitrogen atom, etc. are illustrated.

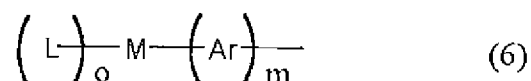
[0055]

As for the aryl group and heterocycle group in R, they are one more or more substituents.  
It may be \*\*\*\*(ing).

[0056]

The structure of a following formula (6) in the metal complex structure which shows  
luminescence from 3-fold paragraph excitation state,

It is desirable.



[0057]

M is a with an atomic numbers of 50 or more atom among a formula, and it is this complex by a  
spin-orbit interaction.

The metal in which he sets and the intersystem crossing between 1-fold paragraph state and 3-  
fold paragraph state can get up is shown.

M is a rhenium, iridium, osmium, a scandium, and ITTORIU.

MU, platinum, gold and europium of lanthanoids, a terbium, a thulium,

A dysprosium, samarium, PURASEOJUMU, gadolinium, etc. are mentioned.

Iridium, platinum, gold, and europium are preferred and especially iridium is preferred.

[0058]

As for M, it is desirable to combine with at least one carbon atom.

[0059]

Ar is one or more of a nitrogen atom, an oxygen atom, a carbon atom, a sulfur atom, or the  
phosphorus atoms, and is M.

It is a ligand to combine and combines with polymer in arbitrary positions.

[0060]

as Ar -- for example, a pyridine ring, a thiophene ring, and benzo -- an oxazole ring

Specifically at the ligand which which heterocycles and benzene ring joined together and was  
constituted, it is Feni.

RUPIRIJIN, 2-(PARAFE nil phenyl) pyridine, 7-bromobenzo [h] kino

Lynn, 2-(4-thiophene 2-yl) pyridine, 2 - (4-phenyl CHIOFE)

\*\*-- 2-yl pyridine, 2-phenylbenzo oxazol, 2 - (PARAFENIRU)

Phenylbenzooxazol, 2-phenylbenzo thiazole, 2 - (PARAFE)

Nil phenylbenzothiazole, 2-(benzothiophene 2-yl) pyridine

7,8,12,13,17,18-hexakisethyl-21 H,23H-porphyrin etc. are illustrated and it is \*\*.

It may have [ \*\* and others ] a substituent.

[0061]

As a substituent of Ar, they are a halogen atom, an alkyl group, an alkenyl group, and ARARUKI.

A RU group, an arylthio group, an aryl alkenyl group, an annular alkenyl group, ARUKOKISHI

A basis, an aryloxy group, an alkyloxy carbonyl group, aralkyloxy carbo

A nil group, an aryloxy carbonyl group, an aryl group, and a univalent heterocycle group are  
mentioned.

It is the same as that of what is illustrated in the above-mentioned R<sub>18</sub> and R<sub>19</sub> as the example.

[0062]

Ar is any of a nitrogen atom, an oxygen atom, a carbon atom, a sulfur atom, or a phosphorus atom especially.

It is preferred that it is 4 seat ligand combined with M by the atom of four \*\*. For example, four Specifically as a ligand with which the \*\* pyrrole ring was connected annularly, it is 7, 8, 12, 13, 17, and 18.

- Hexakisethyl-21 H,23H-porphyrin is mentioned.

[0063]

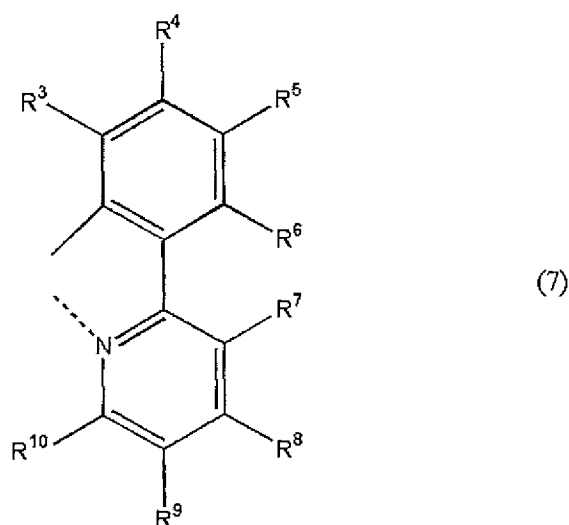
The inside of the above-mentioned (6) types and Ar are a nitrogen atom, an oxygen atom, a carbon atom, and \*\*\*\*\*.

With 2 seat ligand which \*\* are any two atoms of the phosphorus atom, and combines with M and forms a five-membered ring

a certain thing is desirable -- if M combines with at least one carbon atom -- further -- good \*\*

It is more desirable when it is 2 seat ligand to spread and Ar is indicated to be with a following formula (7).

[0064]



(7)

The inside of a formula,  $R^3 - R^{10}$  are a hydrogen atom, a halogen atom, an alkyl group, and A independently, respectively.

A RUKENIRU group, an aralkyl group, an arylthio group, an aryl alkenyl group, annular Al

A KENIRU group, an alkoxy group, an aryloxy group, an alkyloxy carbonyl group, A

A RARUKIRU oxycarbonyl group, an aryloxy carbonyl group, or an aryl group

\*\*\*\*\*. At least one of  $R^3 - R^{10}$  is bond groups with a polymer chain.

[0065]

L is a hydrogen atom, an alkyl group, an aryl group, a heterocyclic ligand, a carboxyl group, and a halo.

A gene atom, an amide group, an imido group, an alkoxy group, an alkyl sulfhydryl group, carbo

A nil ligand, an alkene ligand, an alkyne ligand, an amine ligand, an imine ligand,

A nitril ligand, an isonitrile ligand, a phosphine ligand, phosphine oxide

A ligand, a phosphite ligand, an ether ligand, a sulfone ligand, a sulfoxide

They are a ligand or a sulfide ligand. m shows the integer of 1-5. o is 0-.

The integer of 5 is shown.

[0066]

In L of the above-mentioned general formula (6), they are a methyl group and an ethyl group as an alkyl group,

A propyl group, a butyl group, a cyclohexyl group, etc. are illustrated, and it is as an aryl group. A phenyl group, a tolyl group, 1-naphthyl group, 2-naphthyl group, etc. are illustrated, and it is complex.

As a ring ligand, zerovalency or univalent may be sufficient and it is 2 and 2 as a zerovalent thing.

'-bipyridyl, a 1,10-phenanthroline, 2 - (4-thiophene 2-1)

\*\*) Pyridine, 2-(benzothiophene 2-yl) pyridine, etc. are illustrated,

As a univalent thing, they are for example, phenylpyridine and 2-(PARAFE nil phenyl) PI.

Lysine, 7-bromobenzo [h] quinoline, 2 - (4-phenylthio Feng 2-)

Yl pyridine, 2-phenylbenzo oxazol, 2 - (PARAFE nil phenyl)

Benzooxazol, 2-phenylbenzo thiazole, 2 - (PARAFENIRUFE)

Nil benzothiazole etc. are illustrated.

[0067]

Although not limited especially as a carboxyl group, it is an acetoxy group, for example.

A NAFUTENETO group or 2-ethylhexanoate group is mentioned. Halogen

Although not limited especially as an atom, they are a fluorine atom and a chlorine atom, for example,

A bromine atom, iodine atoms, etc. are mentioned. \*\* limited especially as an amide group

Although it is not \*\*, they are a dimethyl amide group, a diethyl amide group, and diisopropyl, for example.

An amide group, a dioctyl amide group, a didecyl amide group, a didodecyl amide group, a screw (Trimethylsilyl) an amide group, a diphenyl amide group, and N-methylanilide -- moreover

A \*\* anilide group etc. are mentioned. Although it is not what is limited especially as an imido group

For example, benzophenoneimide etc. are mentioned. Especially as an alkoxy group, it is \*\*.

Although not carried out, they are [ constant-] a methoxy group, an ethoxy basis, a propoxy group, and BU, for example.

A TOKISHI group or a phenoxy group is mentioned. As an alkyl sulfhydryl group, it is \*\*.

Although it is alike and is not limited, they are a methylsulfhydryl group and ethylmercapto, for example.

A basis, a propylsulfhydryl group, a butylsulfhydryl group, or a phenylsulfhydryl group

\*\*\*\*\*. As a carbonyl ligand, they are carbon monoxide, acetone, and \*\* NZOFE.

Diketones, such as ketone, such as non, an acetylacetone, and acenaphthoquinone

Acetylacetonato, dibenzo methylate, TENOIRUTORIFURUOROA

Acetonato ligands, such as TO, etc. are illustrated. Especially as an alkene ligand, it is \*\*.

Although not carried out, they are [ constant-] ethylene, propylene, a butene, and hexene \*\*, for example.

As for \*\*, decene etc. are mentioned. what is limited especially as an alkyne ligand -- \*\*\*\*

\*\* is acetylene, phenylacetylene, or diphenylacetylene, for example.

\*\*\*\*\*. although it is not what is limited especially as an amine ligand -- for example

Triethylamine or tributylamine is mentioned. As an imine ligand

Although not \*\*(ed) especially limited, they are benzophenone imine or methyl, for example.

Ethyl ketone imine etc. are mentioned. \*\* limited especially as a nitril ligand

Although it is not \*\*, acetonitrile or benzonitrile is mentioned, for example.

Although not limited especially as an isonitrile ligand, it is t-BUCHI, for example.

RUIISO nitril or phenylisonitrile is mentioned. Phosphine ligand

Especially if it carries out, it is not limited, but they are triphenyl phosphine and TO, for example.

RITORIRU phosphine, tri-cyclohexyl phosphine, or tributyl HOSUFI

N etc. are mentioned. What is limited especially as a phosphine oxide ligand

Although there is nothing, they are tributyl phosphine oxide or triphenyl phosphine, for example.

Oxide etc. are mentioned. What is limited especially as a phosphite ligand  
Although there is nothing, they are triphenyl phosphite, tritolyl phosphite, and TORIBU, for example.

Chill phosphite or triethyl phosphite is mentioned. Ether coordination

Although not limited especially as a child, they are wood ether and JIECHI, for example.

RUETERU or a tetrahydrofuran is mentioned. As a sulfone ligand

although it is not what is limited especially -- for example, a dimethylsulfone or a jib --  
CHIRUSURU

A phon etc. are mentioned. It is not limited especially as a sulfoxide ligand.

\*\*, for example, dimethyl sulfoxide, or a dibutylsulfoxide is mentioned.

.Although not limited especially as a sulfide ligand, it is ECHIRUSU, for example.

RUFIDO or a butylsulfide is mentioned.

[0068]

The polymers photogen of this invention is \*\* about the metal complex structure which shows luminescence from 3-fold paragraph excitation state.

It may have in \*\*\*, and may have in the side chain, and has at the end of a main chain.

\*\*\* is also good.

[0069]

Polymers luminescence which has the metal complex structure which shows luminescence from 3-fold paragraph excitation state in the main chain

The aromatic ring configured in the complex which the body shows luminescence from 3-fold paragraph excitation state, or its condensed ring part

When contained in \*\*\*, the case where metal is contained in a main chain is meant.

[0070]

It is if small among the ligands contained in the metal complex structure of the polymers photogen of this invention.

It is a metal content when one \*\* includes the same structure as the repeating unit contained in a polymers main chain.

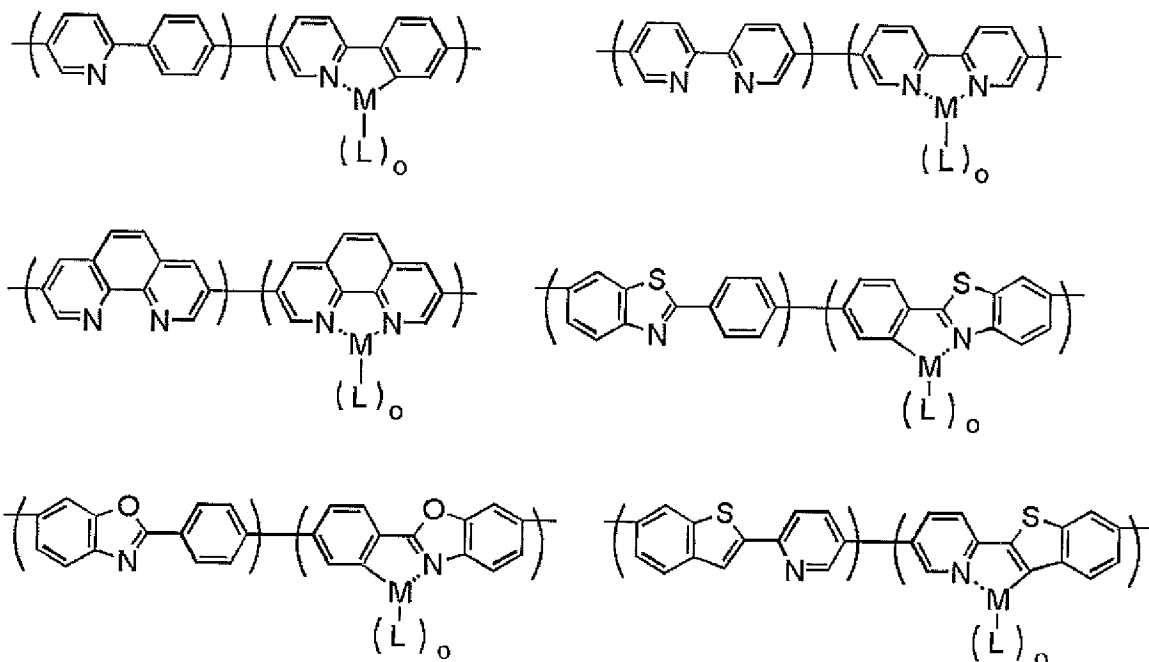
It is desirable at a controllable point.

That is, it is \*\* after manufacturing a high molecular compound, when it has the structure of a ligand in a main chain.

The polymers photogen of this invention can be manufactured by performing embodying.

Specifically, the following structures are illustrated.

[0071]



[0072]

Polymers luminescence which has the metal complex structure which shows luminescence from 3-fold paragraph excitation state in the side chain

The aromatic ring configured in the complex which the body shows luminescence from 3-fold paragraph excitation state, or its condensed ring part

The case where it connects with \*\*\*\*\* via combination is meant. A combination here is a single bond,

Direct coupling of a double bond etc.; atoms, such as an oxygen atom, a sulfur atom, and a selenium atom, were passed.

It is \*\* about divalent bond groups, such as joint; or a methylene group, an alkylene group, and an allylene group.

Combination carried out is shown.

The metal complex style especially which shows luminescence from 3-fold paragraph excitation state to the connected conjugate side chain

It is preferred to have \*\*.

[0073]

It is this gold when it has the metal complex structure which shows luminescence from 3-fold paragraph excitation state in the side chain.

It is [ the aromatic ring contained in at least one ligand of group complex structure, and ] \*\*\*\* to a polymers main chain.

It is desirable to connect the \*\*\*\* aromatic ring by the carbon-carbon single bond.

[0074]

Especially, that whose polymers photogen is a conjugated system polymers photogen is preferred.

With a conjugated system polymers photogen, a non-localization pi electron pair along with the principal chain skeleton of polymer here.

The polymers photogen, i.e., the polymers photogen whose main chains are conjugated system polymers, which exists is meant.

It carries out. As this nonlocalized electron, they are an unpaired electron or a lone-pair electrons instead of a double bond.

It may be added to \*\*\*\*\*.

[0075]

The metal complex in which luminescence from 3-fold paragraph excitation state is shown as one embodiment of this invention

The polymers photogen, i.e., the main chain, which has two or more kinds of structures, a side chain, or an end is.

The from polymers which has a gap or the metal complex structure which show luminescence from 3-fold paragraph excitation state or more in two

It is phaosome. Each metal complex structure may have the same metal of each other.

It may have different metal. Each metal complex structure is \*\* mutually.

It may have the becoming luminescent color. For example, metal complex structure which emits light green and red

The case where it is alike and both metal complex structures which emit light are included in one polymers photogen etc.

It is illustrated. At this time, it designs so that a moderate quantity of metal complex structure may be included.

Since it can be alike and the luminescent color can be controlled more, it is desirable.

[0076]

The metal complex style which shows luminescence from 3-fold paragraph excitation state as a polymers photogen of this invention

[0077]

The join of the remainder in which two hydrogen was desorbed from the ligand of above-mentioned 3-fold paragraph luminescence complex if carried out

[0078]

It carries out and the substituent of  $Ar_1$  of the repeating unit of the after-mentioned type (1) or  $R_1$ , and  $R_2$  are letters of 3-fold paragraph excitation.

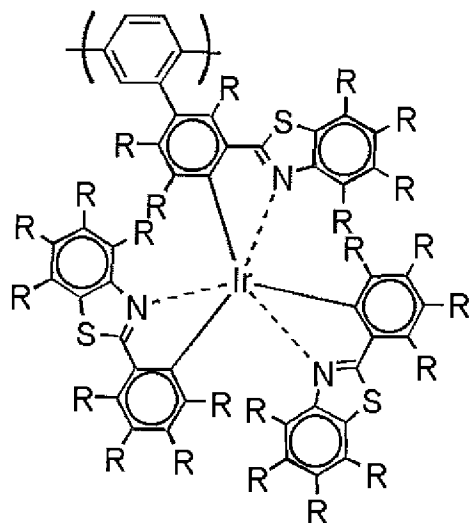
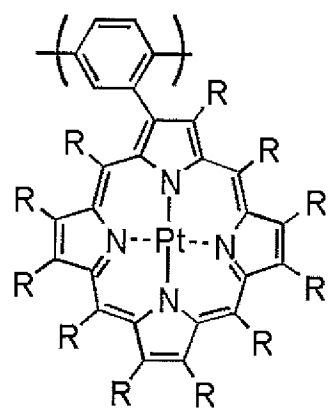
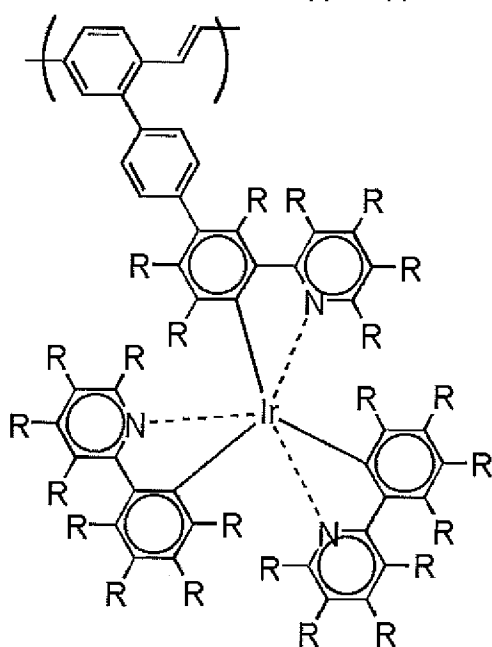
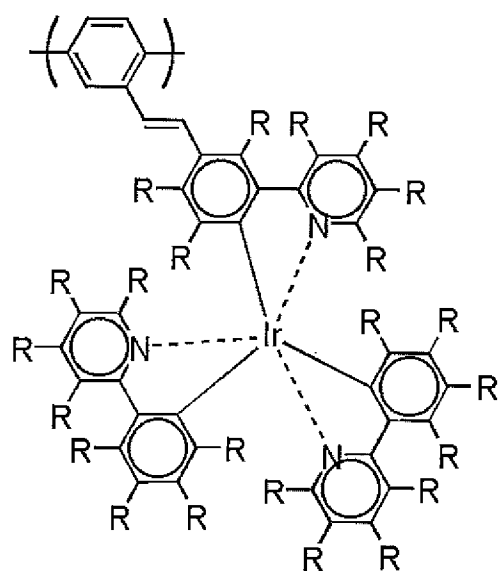
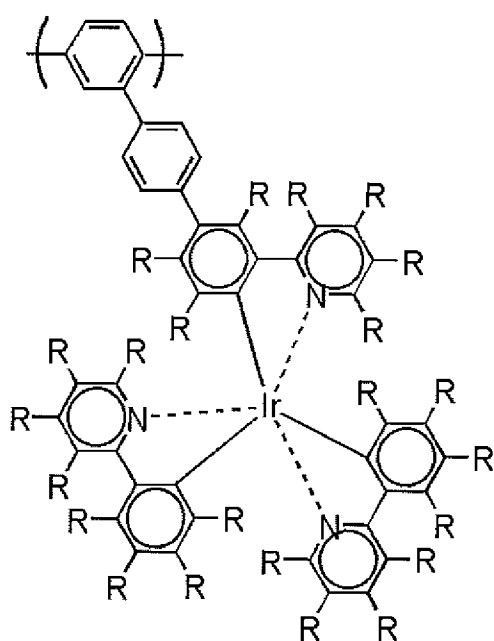
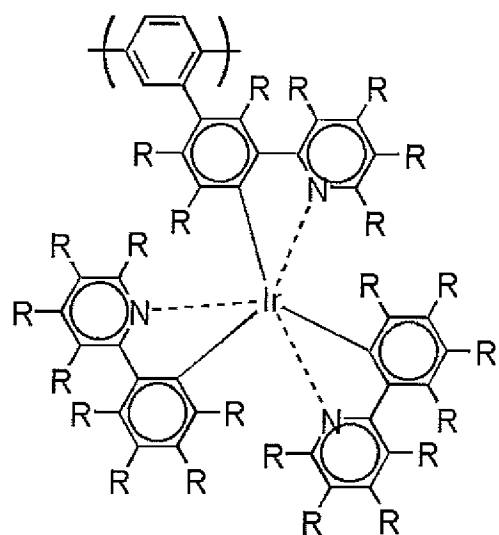
About the univalent basis which has the metal complex structure which shows luminescence from 3-fold paragraph excitation state here

It is a basis.

as the example of the repeating unit which is a univalent basis which has \*\*\*\*\* complex structure -- for example

[0079]

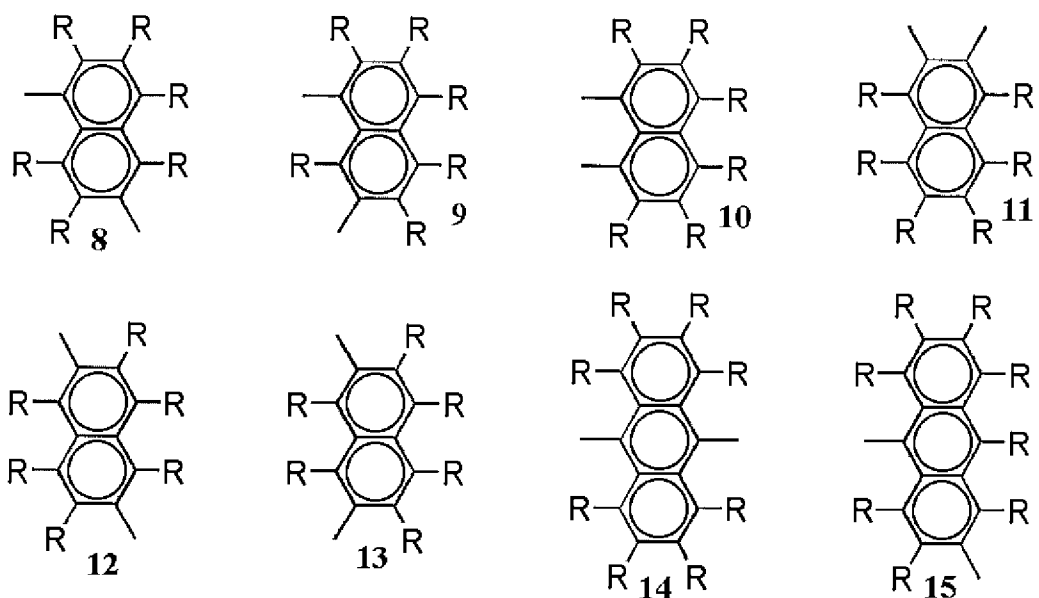




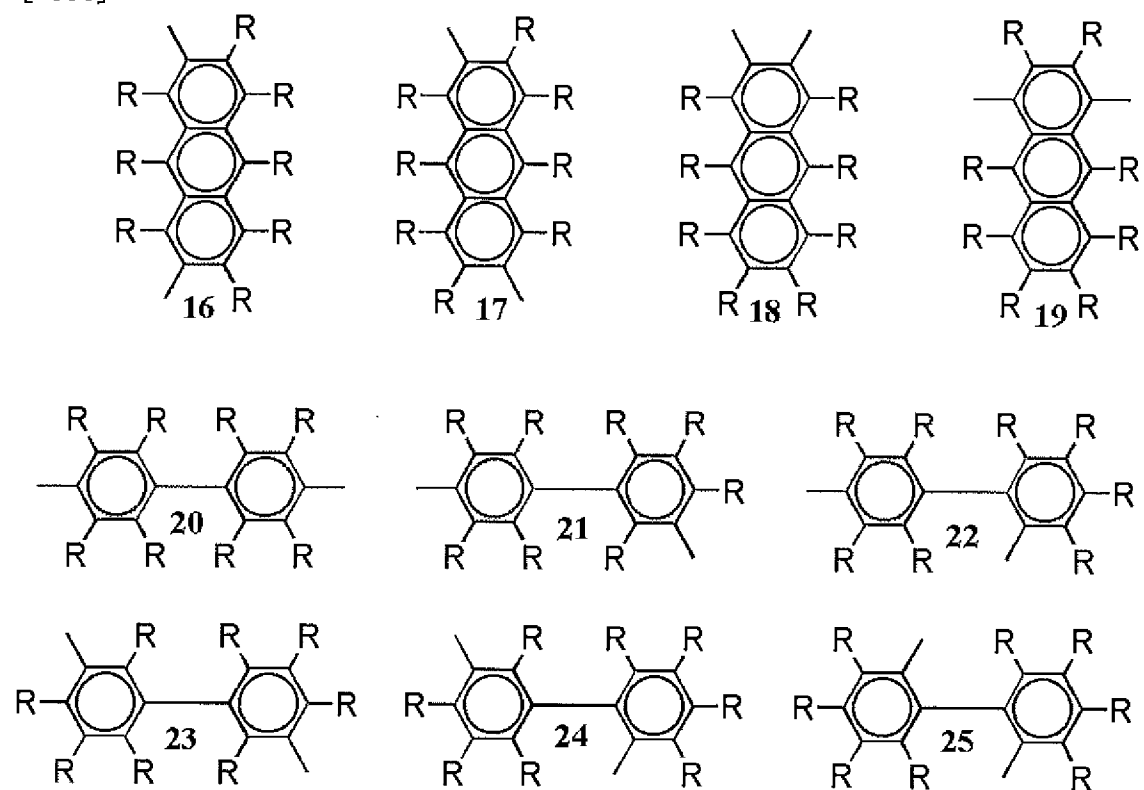
[0080]







[0088]



[0089]



[0092]

Base is hetero atoms, such as not only a carbon atom but oxygen, sulfur, nitrogen, Lynn, boron, etc.

[0093]

[0094]

The formulas 39–44, a diaza phenylene group (formulas 45–48 of the following figure), quinolinediyl

A KURIJIN diyl group (formulas 69-72 of the following figure), a bipyridyldiyl group (formula 73 of the following figure)

It has fluorene structure including a silicon, nitrogen, sulfur, selenium, etc. as a hetero atom.

It has aromatic amine monomers, such as RU and a triphenylaminediyl group.

[0095]

The ceremonies 94–98 of the following figure are held.

The five-membered ring condensation heterocycle group which contains a silicon, nitrogen, sulfur, selenium, etc. as a hetero atom

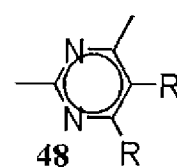
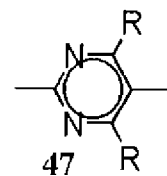
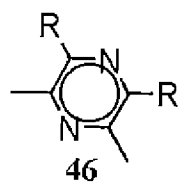
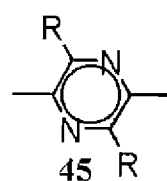
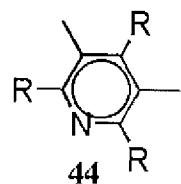
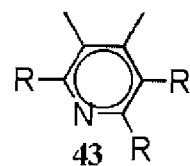
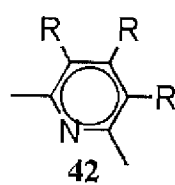
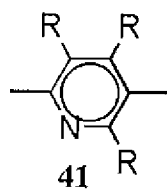
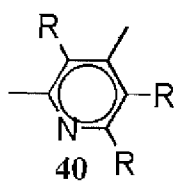
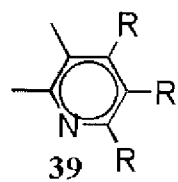
[0097]

Basis which joins together by the alpha position of a \*\* hetero atom, and has become a dimer and oligomer : (formula 1 of the following figure)

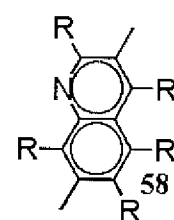
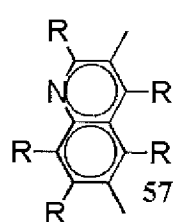
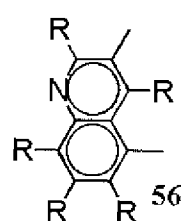
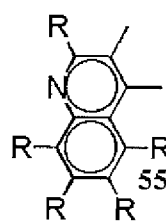
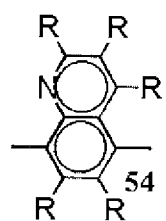
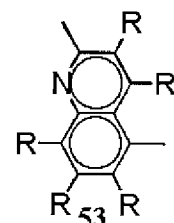
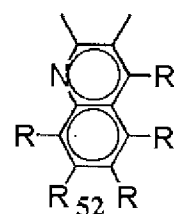
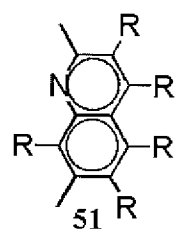
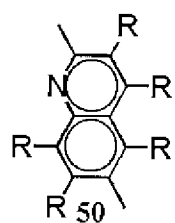
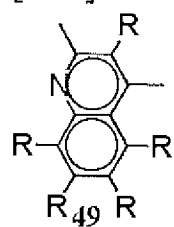
[0098]

Basis combined with the phenyl group by the alpha position of a \*\* hetero atom : (formulas 112-118 of the following figure)

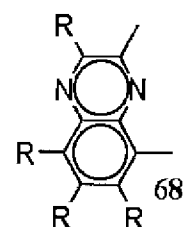
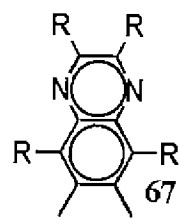
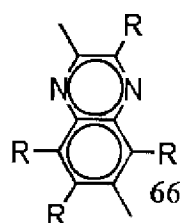
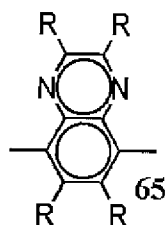
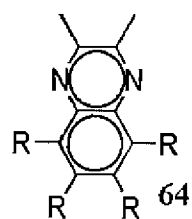
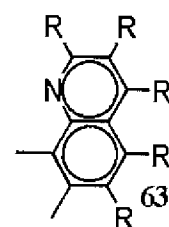
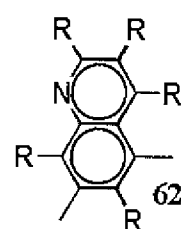
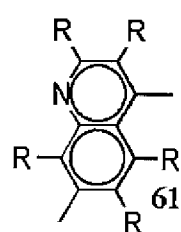
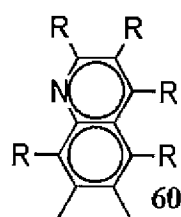
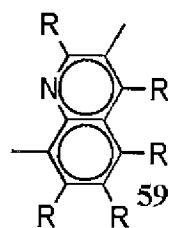
[0099]



[0100]

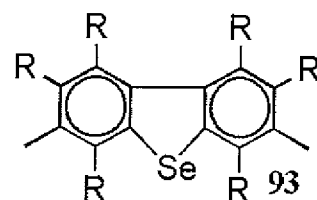
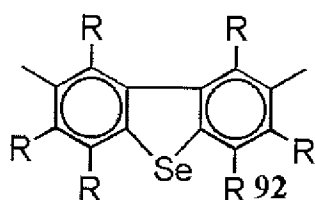
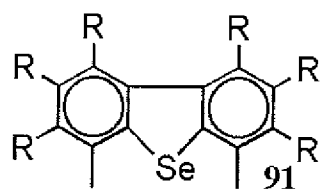
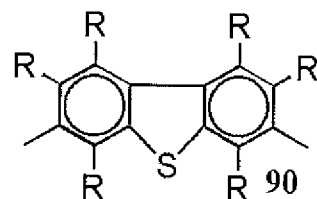
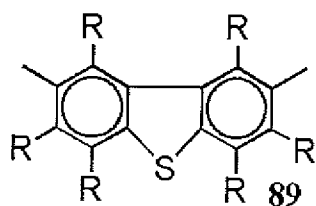
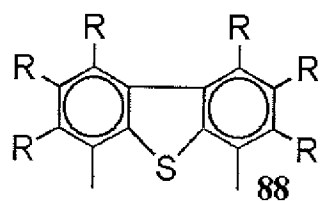
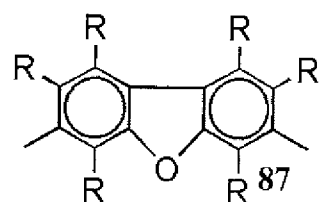
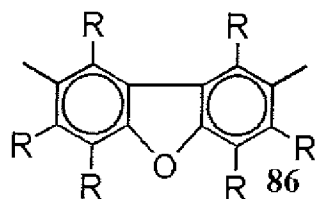
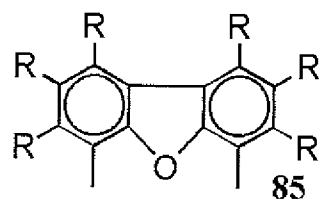


[0101]

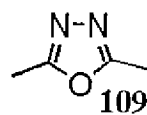
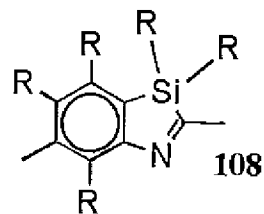
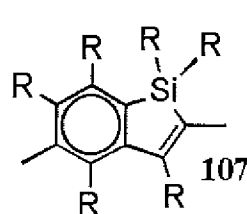
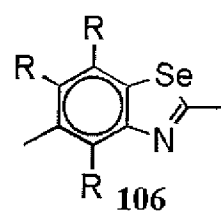
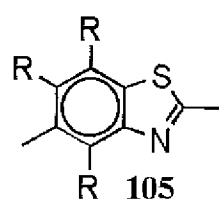
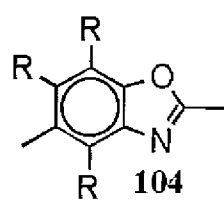
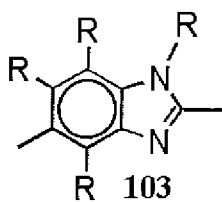
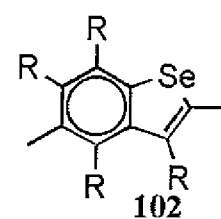
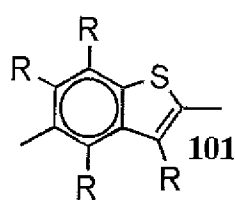
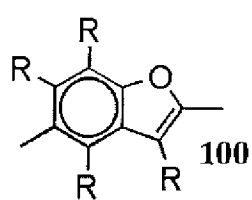
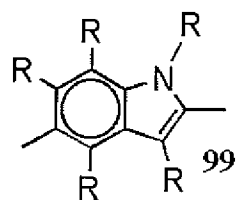
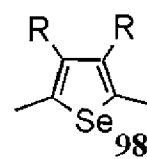
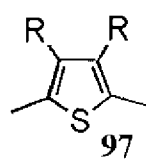
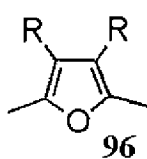
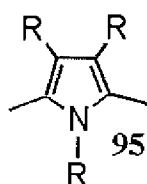
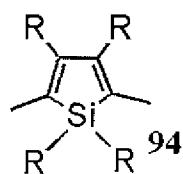




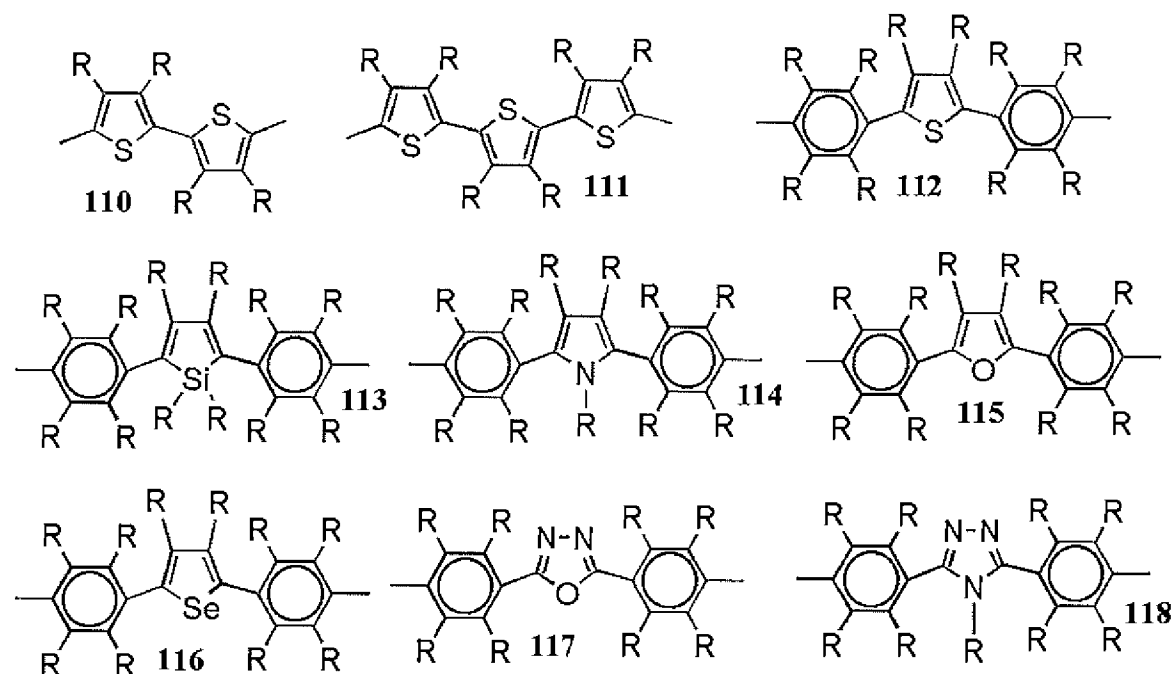




[0106]



[0107]



[0108]

Here, R shows the same basis as \*\*\*\*.

[0109]

n in the above-mentioned formula (1) is 0 or 1.

[0110]

$R_1$  in the above-mentioned formula (1) and  $R_2$  are a hydrogen atom, an alkyl group, and A independently, respectively.

A reel group, a univalent heterocycle group, or a cyano group is shown.

[0111]

It is alkyl when  $R_1$  and  $R_2$  describe the case where it is except a hydrogen atom and a cyano group.

A straight chain, branching, or annular any may be sufficient as a basis, a carbon number is usually one to about 20, and it is \*\*.

In \*\* and a concrete target, they are a methyl group, an ethyl group, a propyl group, a butyl group, a pentyl group, and HE.

A KISHIRU group, a heptyl group, an octyl group, a nonyl group, a decyl group, a lauryl group, etc. are \*\*.

\*\*\*\*\*, a methyl group, an ethyl group, a pentyl group, a hexyl group, a heptyl group, octyl

A basis is preferred.

[0112]

An aryl group is usually six to about 60, and, specifically, a carbon number is a phenyl group,  $C_1 - C_{12}$  alkoxyphenyl group (being [  $C_1 - C_{12}$  / the carbon numbers 1-12 ] \*\*\*\*)

\*\*. The following is also the same.  $C_1 - C_{12}$  alkylphenyl group, 1-naphthyl group,

2-naphthyl group etc. are illustrated --  $C_1 - C_{12}$  alkoxyphenyl group,  $C_1 - C_{12}$

An alkylphenyl group is preferred.

[0113]

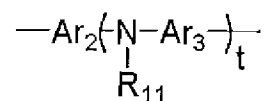
A univalent heterocycle group is usually four to about 60, and, specifically, a carbon number is thienyl.

A basis, a  $C_1 - C_{12}$  alkyl thienyl group, a pyrrolyl group, a furil group, a pyridyl group,  $C_1 -$

$C_{12}$  alkyl pyridyl group etc. are illustrated and they are a thienyl group,  $C_1 - C_{12}$  ARUKIRUCHIE.

[0114]

It is \*\* to include preferably the repeating unit shown with a following formula (2) as grade. It is desirable in respect of optical efficiency.

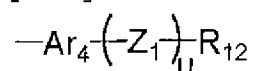


(2)

[0115]

It is and Ar<sub>2</sub> and Ar<sub>3</sub> do not construct a bridge. R<sub>11</sub> is an alkyl group, an aryl group, and univalent.

[0116]



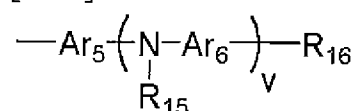
(3)

Ar<sub>4</sub> is an allylene group or a divalent heterocycle group among a formula. R<sub>12</sub> is a hydrogen atom,

It is shown.  $Z_1$ ,  $-CR_{13}=CR_{14}$ , or  $-C^{**}C-$  is expressed.  $R_{13}$  and  $R_{14}$

A NO group is shown. u is an integer of 0-2.

[0117]

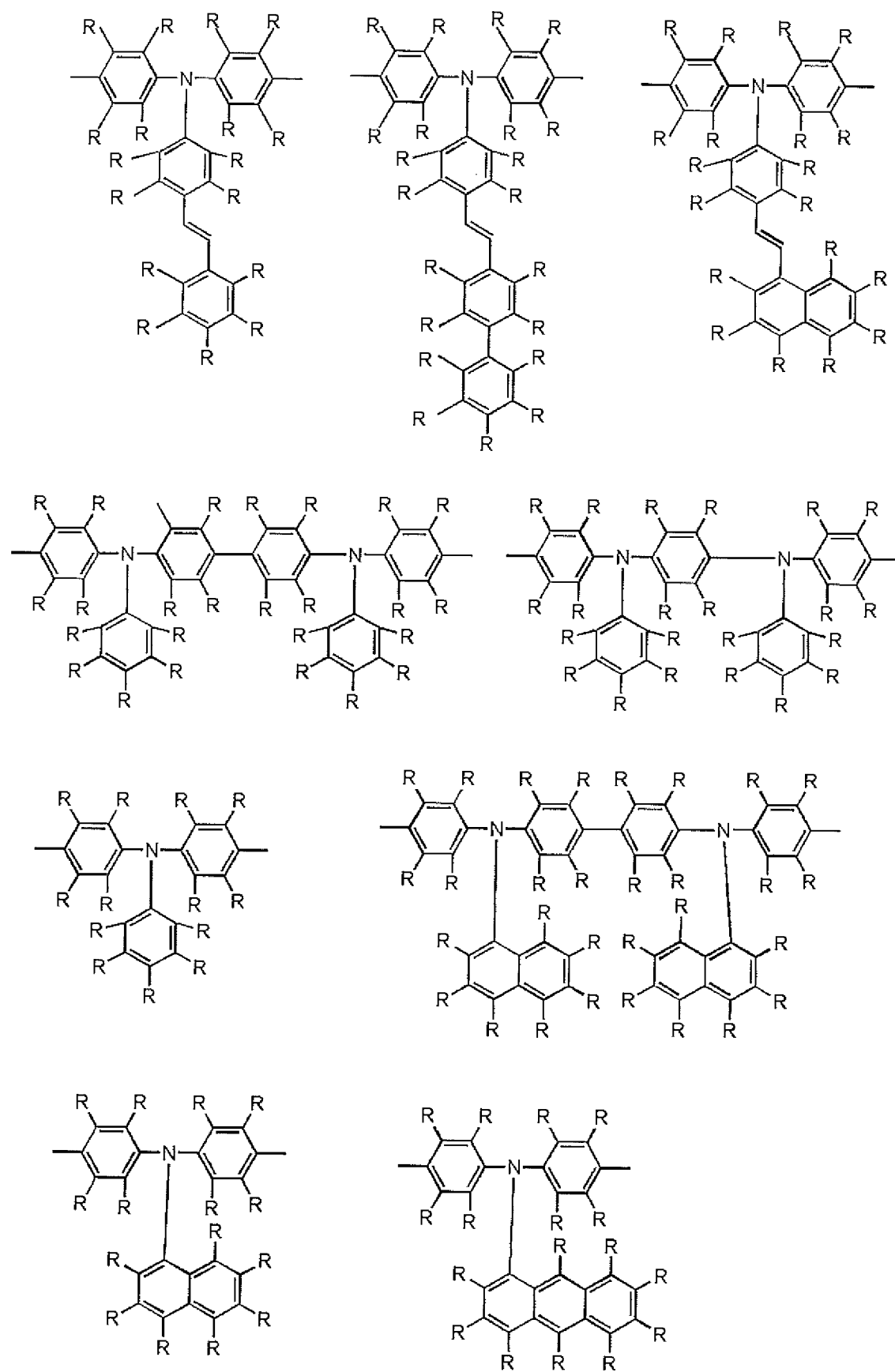


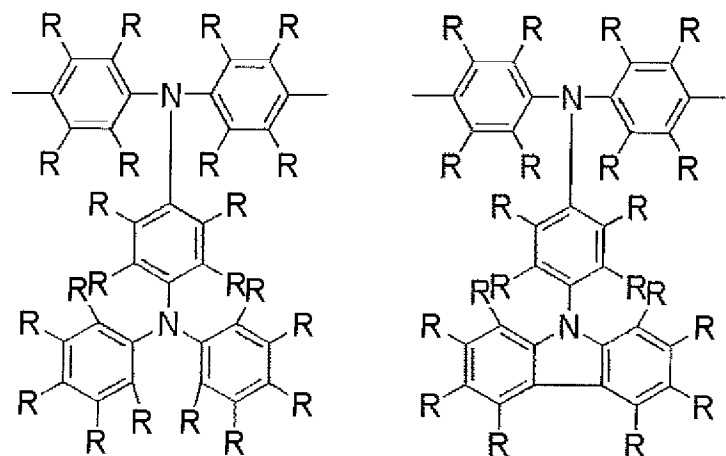
(4)

It is, R<sub>15</sub> shows an alkyl group, an aryl group, or a univalent heterocycle group. R<sub>16</sub>

[0118]

\*\*\*\*\*





R is the same as the above among a formula.

[0119]

As the allylene group in  $Ar_2 - Ar_6$ , and a divalent heterocycle group, it is an example to the above-mentioned  $Ar_1$ .

It is the same as that of what is shown.

As the alkyl group in  $R_{11} - R_{16}$ , an aryl group, and a univalent heterocycle group, it is the above-mentioned R.

It is the same as that of what is illustrated by  $_1$  and  $R_2$ .

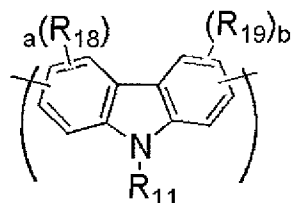
[0120]

The polymers photogen of this invention is wound except the repeating unit shown by the above-mentioned formula (1).

It is luminous efficiency to include the repeating unit shown with a following formula (5) as a return unit.

It is desirable at \*\*\*\*.

[0121]



(5)

$R_{11}$  is the same as the above among a formula.  $R_{18}$  and  $R_{19}$  express the substituent on an aromatic ring, and are halogen.

An atom, an alkyl group, an alkenyl group, an aralkyl group, an arylthio group, ARIRUA

A RUKENIRU group, an annular alkenyl group, an alkoxy group, an aryloxy group, ARUKIRUO

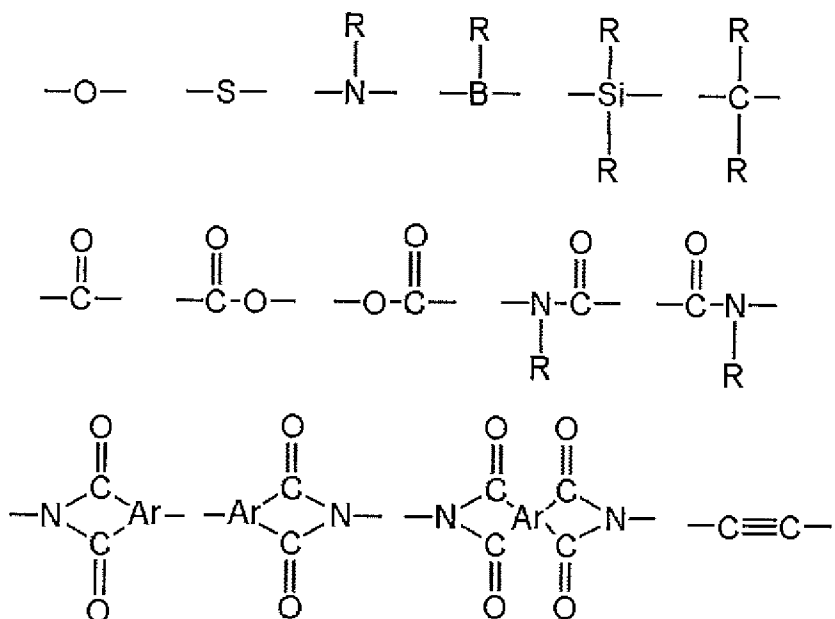


It may be contained. What is shown below as geometry, the thing shown below, and BINI  
It is combination or more in two of the thing which combined the Wren group, and the things  
shown below.

\*\* etc. are illustrated. The basis as which R is chosen from the same substituent as the  
aforementioned thing here

It comes out, and it is and Ar shows the hydrocarbon group of 6-60 carbon numbers.

[0126]



[0127]

By the general formula (1), (2), or (5), it is shown, and winds, and the polymers photogen of this  
invention is \*\*.

The repeating unit which has the metal complex structure of carrying out and indicating  
luminescence from 3-fold paragraph excitation state to be a unit

it has the metal complex structure which shows luminescence from 3-fold paragraph excitation  
state to the sum total -- winding

a return unit -- less than more than 0.01 mol % 10 mol % -- containing is preferred.

[0128]

This polymers photogen is randomness, a block, or a graft copolymer, and is \*\*\*.

It was tinged with the polymers which are good also as for \*\* and have those interim structures,  
for example, block nature.

It may be a random copolymer. The view which obtains a polymers photogen with a high quantum  
yield of luminescence

The random copolymer and BU which are tinged with block nature from a perfect random  
copolymer from a point

A lock or a graft copolymer is preferred.

[0129]

A number average molecular weight is polystyrene conversion, and the polymers photogen of this  
invention is at  $10^3 - 10^8$ .

It is. The total number of the repeated structure changes also with repeated structure or its  
rate.

.Generally the total numbers of repeated structure are 20-1000 preferably from a point of  
membrane formation nature.

0 -- further -- desirable -- 30-10000 -- it is 50-5000 especially preferably

[0130]

Since luminescence from a thin film is used, this polymers photogen is luminescence \*\*\*\* at a solid state.

What is carried out is used suitably.

[0131]

As a good solvent to this polymers photogen, they are chloroform, a methylene chloride, and JIKU.

ROROETAN, a tetrahydrofuran, toluene, xylene, mesitylene, TETORARI

N, a decalin, n-butylbenzene, etc. are illustrated. The structure and the part of a polymers photogen

Although based also on the amount of children, it can be made to usually dissolve in these solvents 0.1% of the weight or more.

\*\*.

[0132]

The polymers photogen of this invention has the polymerization activity group derived from 3-fold paragraph luminescence complex.

It can manufacture by polymerizing using a monomer as a raw material. moreover

The monomer which has the polymerization activity group derived from 3-fold paragraph luminescence complex under polymerization conditions decomposes.

\*\* which has the polymerization activity group derived from 3-fold paragraph luminescence complex when it may carry out

It polymerizes using a quantity object as a raw material, a polymer is obtained, and it is this 3-fold paragraph luminescence complex about this polymer.

It may be made to react to \*\*\*\*\*.

As a polymerization activity group used here, although it changes with polymerization methods, he is Hol, for example.

Halogen atoms, such as a mill group, phosphonium group, bromine, an iodine, and chlorine, a vinyl group,

A halomethyl group, an acetonitrile group, a trifluoromethane sulfonyloxy group, etc.

Aryl sulfo, such as an alkylsulfonyloxy group and a toluenesulfonyloxy group

A nil oxy group is mentioned.

[0133]

When it has a vinylene group in a main chain as a manufacturing method of the polymers photogen of this invention

Accept the monomer which has the polymerization activity group derived from \*\* and 3-fold paragraph luminescence complex, and necessity.

Other monomers are used, for example, it is a method given in JP,5-202355,A.

It can manufacture more.

namely[1]The compound which has an aldehyde group, and the combination which has a phosphonium salt group

The polymerization by a Wittig reaction with a thing, [2]An aldehyde group and a phosphonium salt group

The polymerization by the Wittig reaction of the compound which \*\*\*\*, [3]The compound which has a vinyl group

The polymerization by a Heck reaction with the compound which has a halogen atom [4]A vinyl group and Ha

The polymerization by the Heck reaction of the compound which has the Rogen atom, [5] RUDEHIDO group \*\*\*\*

Horner-Wad of the compound to carry out and the compound which has an alkyl phosphonate group

The polymerization by the sworth-Emmons method [6]An aldehyde group and ARUKIRUHOSUHO









When it is and has a vinylene group in a case at a main chain, it is derived from 3-fold paragraph luminescence complex.

[12]How to polymerize by a Suzuki coupling reaction, [13]Grig

How to polymerize by a hard reaction, [14] How to polymerize according to nickel (0) catalyst

\*\*\*\*\* -- or [16]A method by disassembly of the intermediate polymers which have a suitable leaving group

\*\*\*\* is illustrated.

Above[12]-[16]A formula shows the method of polymerizing until below.

[0146]

[12]



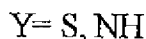
[13]



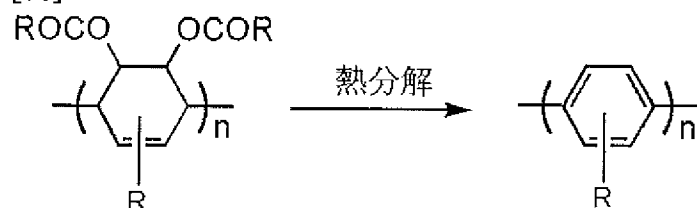
[14]



[15]



[16]



[0151]

A polymerization according to a Wittig reaction among these, the polymerization by a Heck reaction. H

The polymerization by the orner-Wadsworth-Emmons method, Knoeven

It polymerizes by the polymerization by an agel reaction, and a Suzuki coupling reaction.

It is \*\*\*\*\* by the method, the method of polymerizing by a Grignard reaction, and nickel (0) catalyst.

Since it is easy to carry out structure control, **\*\*\*\*\*** is preferred. Furthermore, it is Suzuki coupling.

How to polymerize by a reaction, the method of polymerizing by a Grignard reaction, nickel (0)

Simplicity \*\*\*\*\* of the availability of a raw material and polymerization reaction operation of how to polymerize according to a catalyst

better -- \*\*.

[0152]

A monomer is dissolved in an organic solvent if needed, for example, alkali and a suitable catalyst are used.

It can be made for more than the melting point of an organic solvent to react below in the boiling point. For example, "Olga

Nick Rear KUSHONZU(Organic Reactions)", the 14th volume  
270 – 490 pages, John Wiley Sons And (John Wiley)

& Sons, Inc., 1965, "ORUGA nick rear KUSHONZU (Or)

ganic Reactions", the 27th volume, 345 – 390 pages, JONWA  
Eley And Sons (John Wiley&Sons, Inc.), 19

82 years, "ORUGA nick Synthesis (Organic Syntheses)

" -- collective -- the 6th volume (Collective Volume VI) and 40

7 - 411 pages, John Wiley Sons And (John Wiley&So)

ns, Inc., 1988, chemical Review (Chem.Rev.),

The 95th volume, 2457 pages (1995), journal OBU Organometallic

Chemistry (J. Organomet.Chem.), the 576th volume, 147

A page (1999), journal chemistry OBU (J. P) Practical

rakt.Chem., the 336th volume, 247 pages (1994), macro MOREKI

YURA symposium Chemistry (Makromol) Macromolecular

. Chem., Macromol.Symp., the 12th volume, 229 pages (198)

The publicly known method of a statement can be used in 7 etc.

[0153]

Although it changes as an organic solvent also with the compounds and reactions to be used, generally it is a side reaction.

In order to control, the solvent to be used fully performs deoxidation treatment and reacts by inert atmosphere-ization.

It is preferred to make it go on. It is preferred to perform dehydrating treatment similarly. (

In however, the case of the reaction in a 2 phase system with water like a Suzuki coupling reaction

It is not the limitation.

[0154]

In order to make it react, alkali and a suitable catalyst are added suitably. The reaction which these use

What is necessary is for it to be alike, and to respond and just to choose. This alkali or a catalyst is fully to the solvent used for a reaction.

What is dissolved is preferred. As how to mix alkali or a catalyst, it is reaction mixture.

while stirring under the inert atmosphere of argon, nitrogen, etc. -- slowly -- alkali -- moreover or it adds the solution of \*\*\*\*\* -- reverse -- alkali or the solution of a catalyst -- reaction mixture -- slowly

The method of adding is illustrated.

[0155]

It is the purity when using the polymers photogen of this invention as a luminescent material of polymers LED.

Since \*\*\*\*\* is affected, they are distillation, sublimation refining, recrystallization, etc. about the monomer before a polymerization.

Polymerizing, after refining by a method is preferred, and they are reprecipitation refining after composition, and KUROMA.

It is preferred to carry out purification processing of judgment by a TOGURA fee, etc.

[0156]

In the manufacturing method of the polymers photogen of this invention, each monomer should carry out package mixing.

It may be made to react, and may divide and mix if needed.

[0157]

More concretely, when a reaction condition is described, they are a Wittig reaction and Horner. receiving the functional group of a monomer in the case of a reaction, a Knoevenagel reaction, etc. -- the equivalent -- with

It is made for a top to react using 1-3-Eq alkali preferably. As alkali,

Although not limited in particular, it is potassium t-butoxide and sodium t-BU, for example.

Metal alcoholates, such as TOKISHIDO, sodium ethylate, and lithium methylate

Amide, such as hydride reagents, such as \*\* and sodium hydride, and sodium amide

\*\* can be used. As a solvent, they are N and N-dimethylformamide and TE.

A TORAHIDORO franc, dioxane, toluene, etc. are used. The temperature of a reaction is usual. a \*\* room -- warm -- \*\* -- a reaction can be advanced at about 150 \*\*. reaction time -- for example

What is necessary is just time for a polymerization to fully advance although it is for [ 5 minutes ] - 40 hours, and it is \*\*.

Since it is not necessary to neglect it for a long time after \*\* is completed, it will be preferably for 10 minutes - at 24:00.

It is in between. The concentration in the case of a reaction is a reaction when too deep [ when too thin, the efficiency of a reaction is bad, and ].

since \*\*\*\*\* becomes difficult -- about 0.01 wt(s)% -- the range of the maximum density of which - dissolution is done -- suitably -- \*\*

What is necessary is just to \*\* and it is usually 0.1wt% - 20wt% of a range. Heck reaction

A \*\* case uses a palladium catalyst and is \*\* under existence of bases, such as triethylamine.

A quantity object is made to react. N and N-dimethylformamide, N-methyl pyrrolidone, etc.

Using the high solvent of the \*\*\*\*\* boiling point, reaction temperature is about 80-160 \*\* and reaction time.

It is about 100 hours from 1 hour.

[0158]

It is palladium [TE in the case of a Suzuki coupling reaction as a catalyst, for example.

TORAKISU(triphenyl phosphine)] and palladium acetate are used,

Inorganic bases, such as potassium carbonate, sodium carbonate, and barium hydroxide, a triethyl friend

More than the equivalent is good \*\* to a monomer about the mineral salt of organic bases, such as N, cesium fluoride, etc.

It is made for 1-10 Eq of \*\* to spread to react in addition, using mineral salt as solution -- 2 phase system -- a reaction

\*\*\*\* is also good. As a solvent, they are N and N-dimethylformamide, toluene, and JIME.

TOKISHI ethane, a tetrahydrofuran, etc. are illustrated. Although based also on a solvent, it is 50-1.

The temperature of about 60 \*\* is used suitably. Carry out temperature up and let me return to near the boiling point of a solvent.

\*\* is good. Reaction time is about 200 hours from 1 hour.

[0159]

It is the tetrahydrofuran, diethylether, and JI in the case of a Grignard reaction.

A halogenide and metal Mg are made to react in ether system solvents, such as methoxyethane.

It is considered as a \*\* Grignard reagent solution, and the monomer solution prepared apart from this is mixed,

Carry out temperature up after adding noticing nickel or a palladium catalyst about overresponse.

The method of making it react is illustrated making it return. A Grignard reagent is a monomer.

receiving -- more than the equivalent -- desirable -- 1-1.5 Eq -- more -- desirable -- 1-1.2 Eq -- \*\*

It is. Also when you polymerize by methods other than these, let me react in accordance with a publicly known method.

It can \*\*.

[0160]

The monomer the manufacturing method of the polymers photogen of this invention is indicated to be by  $X_1-A-X_2$  (here)

$X_1$  and  $X_2$  are a halogen atom, alkylsulfonyloxy, or an ant independently, respectively.

- RUSURUHO nil oxy group is shown. -Gold which A- shows luminescence from 3-fold paragraph excitation state

the repeating unit which has group complex structure is shown --  $X_3-D-X_4$  ( $X_3$  and  $X_4$  are here)

They are a halogen atom, an alkylsulfonyloxy group, or ARIRUSURU independently, respectively.

A HONIRU oxy group is shown. D shows repeating units other than A. Existence of a Ni catalyst

It is a manufacturing method made to lower-react.

[0161]

The manufacturing method of the polymers photogen of this invention is  $Y_1-A-Y_2$  ( $Y_1$  and  $Y_2$  are \*\* here).

A boric acid group or an ester-of-boric-acid group is shown in \*\*\*\*\* independence. Monomer shown,

The monomer shown by  $Z_1-D-Z_2$  ( $Z_1$  and  $Z_2$  are a halogen atom and alkyl sulfo NIRUO)

A KISHI group or an arylsulfonyloxy group is shown. D is the same as the above. Pd

It is a manufacturing method made to react under existence of a catalyst.

[0162]

The manufacturing method of the polymers photogen of this invention is  $Y_3-D-Y_4$  ( $Y_3$  and  $Y_4$  are here).

They are a boric acid group or an ester-of-boric-acid group independently, respectively. D is the same as the above. It comes out.

The monomer shown and the monomer shown by  $Z_3-A-Z_4$  ( $Z_1$  and  $Z_2$  are Ha independently, respectively)

The Rogen atom, an alkylsulfonyloxy group, or an arylsulfonyloxy group

being shown -- it is a manufacturing method of the polymers photogen made to react under

existence of a Pd catalyst.

[0163]

the monomer shown by  $X_1-A-X_2$  and the monomer shown by  $Y_1-A-Y_2$  especially -- moreover

The monomer shown by  $Z_3-A-Z_4$  is more than 0.01 mol % to the whole monomer.

It is preferred that it is less than 0 mol %.

[0164]

In the above,  $-A-$  has the metal complex structure which shows luminescence from 3-fold paragraph excitation state.

When it is \*\*\*\*\* and specifically illustrates with a structural formula, it is 3-fold from paragraph of illustration with the above.

Divalent [ used as a joint hand with the repeating unit which any two in R of an optical complex adjoin ]

A \*\* group etc. are mentioned.

[0165]

in the above  $-D-$  -- it is repeating units other than  $A-$ , and, specifically, describes above

The structure shown by the formula (1) and (2) is mentioned.

[0166]

It needs as a halogen atom shown by  $X_1, X_2, X_3, X_4, Z_1, Z_2, Z_3,$  and  $Z_4$ .

Base, bromine, chlorine, etc. are illustrated. As an arylsulfonyloxy group

\*\*, a pentafluorophenyl sulfonyloxy group, PARATORU ene sulfo NIRUOKI

The Si group etc. are methane sulfonyloxy groups as an alkylsulfonyloxy group.

A trifluoromethane sulfonyloxy group etc. are illustrated.

[0167]

As the boric acid group shown by  $Y_1, Y_2, Y_3,$  and  $Y_4$ , and an ester-of-boric-acid group, it is a boric acid group.

The dimethylester of boric acid, the ethylene ester of boric acid, trimethylene boric acid S

Tell etc. are illustrated.

[0168]

As an example made to react under existence of a Ni catalyst, it is a pile for example, by above-mentioned nickel (0) catalyst.

\*\*\*\*\* put together is mentioned.

As a nickel catalyst, it is an ethylene bis(triphenyl phosphine)nickel complex.

A tetrakis (triphenyl phosphine) nickel complex, a screw (cyclo OKUTAJIE)

A nil nickel complex etc. are illustrated.

[0169]

As an example made to react under existence of a Pd catalyst, it is above-mentioned Suzuki KAPPURI, for example.

A NGU reaction is mentioned.

As a palladium catalyst, it is palladium acetate and palladium [tetrakis (truffe).

An ENIRU phosphine] complex, bis(tri-cyclohexyl phosphine)palladium \*\*

The body etc. are illustrated.

[0170]

Gold in which luminescence from 3-fold paragraph excitation state is shown with the manufacturing method of the polymers photogen of this invention

The polymers photogen which has group complex structure in the main chain or side chain of polymer is composition easily.

It comes and is dramatically advantageous industrially.

[0171]

Next, the complex of this invention is explained.

The complexes of this invention are a bromine atom as a reactive functional group, a chlorine atom, an iodine atom, and A.

It is \*\* about the ligand which has a reel sulfonyloxy group, an alkylsulfonyloxy group, etc.





Lysine, 7-bromobenzo [h] quinoline, 2 - (5-bromo-4-thiophene)  
 2-yl pyridine, 2-(5-bromo-4-phenylthio Feng 2-yl) PI  
 Lysine, 2-meta-bromo phenylbenzo oxazol, 2 - (meta-bromo-paraph)  
 ENIRU phenylbenzooxazol, 2-meta-bromo phenylbenzo CHIAZO  
 RU, 2 -- (meta-\*\*\*\*\*-\*\*\*\* phenylphenyl) Benzothiazole, 2 - (6-BU)  
 ROMOBENZO thiophene 2-yl pyridine, the 2-bromo- 7, 8, 12, 13, and 17, 18-HEKI  
 Sukis ethyl-21 H,23H-porphyrin, a 6-bromo-1,10-phenanthroline, Ben  
 Aceto [ \*\*\*\*\*-\*\*\*\* bromobenzo yl-methane, / trifluoro(4-BUROMOTE noil) ]  
 N etc. are illustrated and it is 2. - Meta-bromophenylpyridine, 7-bromobenzo [h]  
 Quinoline, 2-meta-bromo phenylbenzo oxazol, 2-meta-bromo FENI  
 A RUBENZO thiazole etc. are preferred.

[0177]

Ligand Ar' of the complex shown by a general formula (9) is a halogen atom, an alkyl group, and Al.

A KENIRU group, an aralkyl group, an arylthio group, an aryl alkenyl group, annular ARUKE

A nil group, an alkoxy group, an aryloxy group, an alkyloxy carbonyl group, ARA

It may have substituents, such as a RUKIRU oxycarbonyl group and an aryl group.

[0178]

As an example of the substituent of Ar', it is as follows.

As a halogen atom, a fluorine atom, a chlorine atom, a bromine atom, iodine atom, etc. are A.

As a RUKIRU group, they are a methyl group, an ethyl group, n-propyl group, an isopropyl group, and n-BU.

A chill group, an isobutyl group, t-butyl group, n-amyl group, a neopentyl group, n-HEKI

A sill group, a cyclohexyl group, n-octyl group, n-nonyl group, 2 and 3, 4-TORIMECHIRU

A-3-pentyl group, a 2,4-dimethyl- 3-pentyl group, etc.,

As an alkenyl group, a 2-methyl-1-propenyl group, 2-butenyl group, etc.,

As an aralkyl group, they are benzyl, 2-phenylethyl group, and 2-naphthyl ethyl group.

In a thiophenyl group etc., a diphenylmethyl group etc. as an arylthio group,

As an aryl alkenyl group, it is transformer beta styryl group and 3-phenyl-1-PUROPE.

In 1-cyclohexenyl group etc., a nil group etc. are A as an annular alkenyl group.

As a RUKOKISHI group, they are a methoxy group, an ethoxy basis, n-propoxy group, and t-butoxy group.

\*\*\*\* are a phenoxy group, a naphthyloxy group, and JIFENI as an aryloxy group.

A RUOKISHI group etc. are methoxycarbonyl groups as an alkyloxy carbonyl group.

An ethoxycarbonyl group, t-butyloxy carbonyl group, aralkyl OKISHIKA

As a RUBONIRU group, a benzyloxycarbonyl group etc. are aryloxy carbo.

As a nil group, a phenyloxy carbonyl group etc. are FE as an aryl group.

A nil group, a naphthyl group, a biphenyl group, a furil group, etc. are illustrated, respectively.

[0179]

Substituents other than the above-mentioned halogen atom are a fluorine atom and a chlorine atom, for example,

Halogen atoms, such as a bromine atom and iodine atom; a methoxy group, an ethoxy basis, n-PUROPO

ARIRUOKI, such as alkoxy groups, such as a KISHI group and t-butoxy group, and a phenoxy group

Si group; a methyl group, an ethyl group, n-propyl group, an isopropyl group, n-butyl group, I

A SOBUCHIRU group, t-butyl group, n-amyl group, a neopentyl group, n-hexyl group, etc.

\*\* low-grade alkyl group; low-grade ARUKIRUCHI, such as n-propyl thio group and t-butyl thio group

O group; it is replaced by arylthio groups, such as a phenylthio group, a nitro group, the hydroxyl group, etc.

\*\*\*\*\* is also good.

[0180]

In L' of the above-mentioned formula (9), they are an alkyl group, an aryl group, and a heterocyclic ligand.

A carboxyl group, a halogen atom, an amide group, an imido group, an alkoxy group, ARUKI

A RUMERUKAPUTO group, a carbonyl ligand, an alkene ligand, an alkyne ligand, amine

A ligand, an imine ligand, a nitril ligand, an isonitrile ligand, phosphine coordination

A child, the phosphine oxide ligand, a phosphite ligand, an ether ligand, sulfo

As the ligand shown by the N ligand, the sulfoxide ligand, or a sulfide ligand

It is the same as that of the thing of the illustration to L in \*\* and the above-mentioned formula (6).

[0181]

As an example of the complex (9) of this invention, central metal M' is an iridium field, for example.

As a child's thing, it is tris(2-meta-bromophenylpyridine) iridium (III),

Bis(2-meta-bromophenylpyridine)(phenylpyridine) iridium (III),

2-meta-bromophenylpyridine JI (phenylpyridine) iridium (III), a screw

7-bromobenzo [h] quinoline acetylacetonato iridium (III) and a screw -- {

2-(5-bromothiophene 2-yl) pyridine} acetylacetonato IRIJI

UMU (III), bis(2-(3-bromophenyl) benzooxazol)ASECHIRUASE

TONATO iridium (III), a screw (2-(3-bromophenyl) benzothiazole)

Acetylacetonato iridium (III), screw {2 - (5-bromobenzo CHIOFE)

\*\* - 2-yl pyridine} acetylacetonato iridium (III) etc. are mentioned.

[0182]

Central metal M' is a screw (2-meta-bromophenyl) as a thing of a platinum atom.

Pyridineplatina (II) (phenyl(2-meta-bromophenylpyridine) pyridine),

Platina (II) (7-bromobenzo [h] quinoline), acetylacetonato PURACHI

NA (II), [2-(5-bromothiophene 2-yl) pyridin] acetyl ASETONA

- TOPURACHINA (II), ASECHIRUA (2-(3-bromophenyl) benzooxazol)

SETONATOPURACHINA (II), ASECHI (2-(3-bromophenyl) benzothiazole)

RUASETONATO platina (II), [2 - (5-bromobenzo thiophene 2-yl)

Pyridine} acetylacetonato platina (II) etc. are mentioned.

[0183]

Central metal M' is tris (2-meta-bromophenyl) as the Kinbara child's thing.

Pyridinegold (III), a screw (2-meta-bromophenylpyridine) (phenylpyridine)

Golden (III), JI (2-meta-bromophenylpyridine) (phenylpyridine) gold (III), BI

SU (7-bromobenzo [h] quinoline) acetylacetonato gold (III), screw {2 -

5-bromothiophene 2-yl pyridine} acetylacetonato gold (III), BI

SU (2-(3-bromophenyl) benzooxazol) acetylacetonato gold (III)

Bis(2-(3-bromophenyl) benzothiazole)acetylacetonato gold

III) Bis[2-(5-bromobenzo thiophene 2-yl) pyridine] ASECHIRUA

SETONATO gold (III) etc. are mentioned.

[0184]

The central metal M' is as a thing of an europium atom (the 6-bromo- 1, 10-FU),

ENANTORORIN tris(dibenzoylmethane) europium (III) (6-bromo- 1),

10-phenanthroline tris [(4-BUROMOTE noil) trifluoroacetone] YU

- ROPIUMU (III) etc. are mentioned.

[0185]

Ar' is 2 seat ligand shown by a general formula (10) especially, and it is one of R<sup>21</sup> - the R<sup>28</sup>.

That whose above is a bromine atom is more preferred, and R<sup>23</sup> is [ others ] hydrogen atoms in a bromine atom.

Especially a certain thing is preferred.



A RU group is shown. At least one of R<sup>21</sup> – R<sup>28</sup> is a bromine atom.

General formula (11)



As L', they are a carboxyl group, a diketo NATO ligand, an amide group, and an imido group, A carbonyl ligand, an arene ligand, an alkene ligand, an alkyne ligand, imine



Chromatography (dichloromethane elution) refines and it is fractionation solution \*\*\*\* of an object.

Adequate amount \*\*\*\*\* concentration of \*\* (poor solvent), for example, the methanol, is carried out, and an object complex is deposited,

Filter this, it is made to dry and a complex is obtained. The complex (9) of this invention and (10)

A manufacturing method is not limited to a described method.

[0195]

A polymers photogen is manufactured by using the complex of this invention as a monomer.

It can \*\*.

[0196]

Next, polymers LED of this invention is explained. Polymers LED of this invention is the sun.

To inter-electrode [ which consists of a pole and the negative pole ], it is polymers LED which has a luminous layer, and this luminous layer,

The polymers photogen of this invention is included.

[0197]

As polymers LED of this invention, it is an electron transport layer between the negative pole and a luminous layer.

Polymers LED which provided the electron hole transporting bed between polymers LED and the anode which were provided, and a luminous layer

An electron transport layer is provided between the negative pole and a luminous layer, and it is an electron hole between the anode and a luminous layer.

Polymers LED etc. which provided the transporting bed are mentioned.

the above -- adjoining this electrode between one electrode and a luminous layer, even if small --  
- conductive quantity

Polymers LED which provided the layer containing a molecule; it is \*\* between at least one electrode and a luminous layer.

LED which adjoined the electrode and provided the buffer layer of 2 nm or less of average thickness is mentioned.

[0198]

Specifically, the following structures of a~d are illustrated.

a) The anode / luminous layer / negative pole

b) The anode / electron hole transporting bed / luminous layer / negative pole

c) The anode / luminous layer / electron transport layer / negative pole

d) The anode / electron hole transporting bed / luminous layer / electron transport layer / negative pole

(Here, it is shown that each class adjoins and / is laminated.) It is below the same.

[0199]

Here, a luminous layer is a layer which has a function which emits light, and an electron hole transporting bed is an electron hole.

It is a layer which has a function to convey and has the function to convey an electron, with an electron transport layer.

It is \*\*\*\*. An electron transport layer and an electron hole transporting bed are generically called a charge transport layer.

A luminous layer, an electron hole transporting bed, and an electron transport layer may be used more than two-layer independently, respectively.

[0200]

It is \*\* about the electric charge injection efficiency from the electrode among the charge transport layers which adjoined the electrode and were provided.

Especially the thing that has a function which carries out the good and has the effect of dropping the driver voltage of an element is electric charge pouring.

Generally it may be called a layer (a hole injection layer, an electronic injection layer).

[0201]

Furthermore for an improvement of the improvement in adhesion with an electrode, and electric charge pouring from an electrode, an electrode is adjoined.

It may carry out, and the aforementioned electric charge pouring layer or the insulating layer of 2 nm or less of thickness may be provided, and it is an interface.

A buffer thin to the interface of a charge transport layer or a luminous layer for a \*\*\*\*\* disposition top, mixed prevention, etc.

- layer may be inserted.

[0202]

About the turn of the layer to laminate, a number, and the thickness of each class, they are luminous efficiency and an element life.

It can take into consideration and can use suitably.

[0203]

Polymers LE which provided the electric charge pouring layer (an electronic injection layer, a hole injection layer) in this invention

Polymers LED which adjoined the negative pole and provided the electric charge pouring layer as D, and the anode are adjoined.

Polymers LED which provided the electric charge pouring layer is mentioned.

[0204]

For example, specifically, the following structures of e-p are mentioned.

e) The anode / electric charge pouring layer / luminous layer / negative pole

f) The anode / luminous layer / electric charge pouring layer / negative pole

g) The anode / electric charge pouring layer / luminous layer / electric charge pouring layer / negative pole

h) The anode / electric charge pouring layer / electron hole transporting bed / luminous layer / negative pole

i) The anode / electron hole transporting bed / luminous layer / electric charge pouring layer / negative pole

j) The anode / electric charge pouring layer / electron hole transporting bed / luminous layer / electric charge pouring layer / negative pole

k) The anode / electric charge pouring layer / luminous layer / charge transport layer / negative pole

l) The anode / luminous layer / electron transport layer / electric charge pouring layer / negative pole

m) The anode / electric charge pouring layer / luminous layer / electron transport layer / electric charge pouring layer / negative pole

n) The anode / electric charge pouring layer / electron hole transporting bed / luminous layer / charge transport layer / negative pole

o) The anode / electron hole transporting bed / luminous layer / electron transport layer / electric charge pouring layer / negative pole

p) The anode / electric charge pouring layer / electron hole transporting bed / luminous layer / electron transport layer / electric charge pouring layer / negative pole

[0205]

A layer, the anode and the electron hole transporting bed which contain a conductive polymer as a concrete example of an electric charge pouring layer

A middle value with the hole transporting material which is provided in between and included in an anode material and an electron hole transporting bed

It provides between a layer, and the negative pole and the electron transport layer containing the material which has \*\* ionization potential.

Electron affinity of the middle value of \*\*\*\*, a cathode material, and the electron transport material included in an electron transport layer

The layer containing the material which \*\*\*\* are illustrated.

[0206]

In the case of the layer in which the above-mentioned electric charge pouring layer contains a conductive polymer, it is the electrical conductivity of this conductive polymer.

It is preferred that  $\sigma$  and more than  $10^{-5} \text{ S/cm}$  are below  $10^3 \text{ S/cm}$ , and it is between emission pixels.

In order to make  $\sigma$  leakage current small, in more than  $10^{-5} \text{ S/cm}$ , below  $10^2 \text{ S/cm}$ .

It is more desirable and below  $10^1 \text{ S/cm}$  is [ more than  $10^{-5} \text{ S/cm}$  ] still more preferred.

[0207]

Usually, more than  $10^{-5} \text{ S/cm}$  is the electrical conductivity of this conductive polymer Below  $10^3 \text{ S/cm}$

In order to carry out, optimum dose of ion is doped to this conductive polymer.

[0208]

If the kind of ion to dope is a hole injection layer, be with an anion and an electronic injection layer.

It is a  $\sigma$  cation. As an example of an anion, they are polystyrene sulfonate ion and A.

RUKIRU benzenesulfonic acid ion, camphor sulfonic acid ion, etc. are illustrated, and it is KACHI.

As an example of one, they are a lithium ion, sodium ion, potassium ion, and Thet.

Love chill ammonium ion etc. are illustrated.

[0209]

As thickness of an electric charge pouring layer, it is 1 nm – 100 nm, for example, and is 2nm–50.

nm is preferred.

[0210]

The material used for an electric charge pouring layer is selection  $\sigma$  suitably by a relation with the material of an electrode or the adjoining layer.

$\sigma$  is good and they are poly aniline and its derivative, a polythiophene and its derivative, and PO.

RIPRORU and its derivative, polyphenylene vinylene and its derivative, Pori

Thienylene vinylene and its derivative, polyquinoline and its derivative, PORIKI

NOKISARIN and its derivative, the polymer that includes aromatic amine structure in a main chain or a side chain

Which conductive polymer, metal phthalocyanines (copper phthalocyanine etc.), carbon

$\sigma$  is illustrated.

[0211]

The insulating layer of 2 nm or less of thickness has a function which makes electric charge pouring easy. Above

as the material of an account insulating layer -- metal fluoride, a metallic oxide, an organic insulating material, etc. -- mentioning

$\sigma$ . The negative pole is adjoined as polymers LED which provided the insulating layer of 2 nm or less of thickness.

Polymers LED which provided the insulating layer of 2 nm or less of thickness, and the anode are adjoined, and they are 2 nm or less of thickness.

Polymers LED which provided  $\sigma$  is mentioned.

[0212]

Concrete for example, the structure of following q-ab is mentioned.

q) The insulating layer / luminous layer / negative pole of 2 nm or less of the anode / thickness

r) The insulating layer/negative pole of 2 nm or less of the anode / luminous layer / thickness

s) The insulating layer/negative pole of 2 nm or less of the insulating layer / luminous layer / thickness of 2 nm or less of the anode / thickness

t) The insulating layer / electron hole transporting bed / luminous layer / negative pole of 2 nm or less of the anode / thickness

u) The insulating layer/negative pole of 2 nm or less of the anode / electron hole transporting bed / luminous layer / thickness

v) \*\* of 2 nm or less of the insulating layer / electron hole transporting bed / luminous layer / thickness of 2 nm or less of the anode / thickness

\*\*\*\*/negative pole

w) The insulating layer / luminous layer / electron transport layer / negative pole of 2 nm or less of the anode / thickness

x) The insulating layer/negative pole of 2 nm or less of the anode / luminous layer / electron transport layer / thickness

y) \*\* of 2 nm or less of the insulating layer / luminous layer / electron transport layer / thickness of 2 nm or less of the anode / thickness

\*\*\*\*/negative pole

z) The insulating layer / electron hole transporting bed / luminous layer / electron transport layer / negative pole of 2 nm or less of the anode / thickness

aa) The insulating layer/negative pole of 2 nm or less of the anode / electron hole transporting bed / luminous layer / electron transport layer / thickness

ab) The insulating layer / electron hole transporting bed / luminous layer / electron transport layer / thickness of 2 nm or less of the anode / thickness

An insulating layer/negative pole of 2 nm or less

[0213]

\*\* which uses the polymers photogen of the organic solvent fusibility of this invention in the case of polymers LED creation

When it is alike and forms membranes from a solution more, after-spreading desiccation removes a solvent for this solution.

Also in the case where \*\*\*\* may be sufficient and a charge transporting material and a luminescent material are mixed, it is the same technique.

It can \*\*\*\*\* and is dramatically advantageous on manufacture. As a method for film deposition from a solution, it is SUPINKO.

The - TO method, casting method, the micro gravure coating method, the gravure coating method, BA

The - coat method, the roll coat method, the wire bar coat method, a dip coating method, SUPU

The rhe coat method, screen printing, flexo print processes, offset printing, ink

The applying methods, such as the jet printing method, can be used.

[0214]

As thickness of a luminous layer, with the material to be used, optimum values differ and light is emitted with driver voltage.

Although what is necessary is just to choose so that efficiency may serve as a moderate value, it is 1 micrometer, for example from 1 nm.

It is 2 nm - 500 nm preferably, and they are 5 nm - 200 nm still more preferably.

It comes out.

[0215]

In polymers LED of this invention, they are luminescent materials other than the above-mentioned polymers photogen to a luminous layer.

It may be mixed and used. In polymers LED of this invention, it is a part for the above-mentioned quantity.

The luminous layer and lamination which the luminous layer containing luminescent materials other than a child photogen includes for the above-mentioned polymers photogen

It may be carried out.

[0216]

A publicly known thing can be used as this luminescent material. a low molecular weight compound -- for example

A naphthalene derivative, anthracene or its derivative, perylene, or its \*\*

Coloring matter, such as a conductor, a poly methine system, a xanthene series, a coumarin series, and a cyanine system, 8

- Hydroxyquinoline or the metal complex of the derivative, aromatic amine, TETORAFU



[0217]

[0218]

if it carries out -- a polyvinyl carbazole or its derivative, and polysilane -- or -- the

A ZORIN derivative, an arylamine derivative, a stilbene derivative, triphenyl JIAMI

The body, polypyrrole or its derivative, and poly (p-phenylenevinylene) are also spread.

[0219]

-The No. 175860 gazette, JP,2-135359,A, 2-135361

What is indicated in the No. 4 gazette is illustrated.

To - RU or its derivative, polysilane or its derivative, a side chain, or a main chain

Or the derivative, poly (2,5-thienylene vinylene), or \*\*

BAZORU or its derivative, polysilane or its derivative, a side chain, or the Lord

it is preferred to distribute a high polymer binder in a \*\* case, and to use for it.

A polyvinyl carbazole or its derivative is a mosquito, for example from a vinyl monomer.

0222]

iv. -- the 89th volume, 1359 pages (1989), and the British patent GB No. 2300196

Although it can be, especially the Kipping method is used suitably.

to siloxane skeletal structure, electron hole transportability a polysiloxane or its derivative.

\* is used suitably. It has especially the aromatic amine of electron hole transportability in a side chain or a main chain.

02247

Although there is no restriction in the method of membrane formation of an electron hole transporting bed, with a low molecule hole transporting material, it is polymers BA.

Polymers \*\*\*\*\*

In \*\*\*\*\*, the method by the membrane formation from a solution is illustrated.

[0225]

As a solvent used for the membrane formation from a solution, a hole transporting material is dissolved and it is that.

There are not \*\*, especially restriction. As this solvent, they are chloroform, a methylene chloride, and JIKUROROETA.

Ether system solvents, such as chlorine-based solvents, such as N, and a tetrahydrofuran, toluene, KISHIRE

Ketone solvent, such as aromatic hydrocarbon system solvents, such as N, acetone, and methyl ethyl ketone

Ester solvent, such as ethyl acetate, butyl acetate, and ethyl Cellosolve acetate.

It is illustrated.

[0226]

As a method for film deposition from a solution, they are a spin coat method from a solution, and casting method.

The micro gravure coating method, the gravure coating method, the bar coat method, a roll coat Law, the wire bar coat method, a dip coating method, a spray coating method, a screen \*\*, such as print processes, flexo print processes, offset printing, and the ink jet printing method

A cloth method can be used.

[0227]

As a high polymer binder to mix, it is good \*\* which does not check charge transport to a degree very much.

BA spreads and what has the not strong absorption to visible light is used suitably. This polymers

inda \*\* is carried out and they are polycarbonate, polyacrylate, and polymethyl AKURIRE. TO, polymethylmethacrylate, polystyrene, polyvinyl chloride, polish ROKISA

N etc. are illustrated.

[0228]

As thickness of an electron hole transporting bed, an optimum value changes with materials to be used, and it is driver voltage.

Although what is necessary is just to choose  $\theta$  so that luminous efficiency may serve as a moderate value, a pinhole is  $\frac{1}{2}$  at least.

When thickness which does not carry out raw is required and not much thick, the driver voltage of an element is \*\*\*\*\* highly.

etter -- there is no \*\*. Therefore, as thickness of this electron hole transporting bed, it is 1 micrometer, for example from 1 nm.

is, is 2 nm – 500 nm preferably, and is 5nm-200 still more preferably.

is nm.

02297

The electron transport material used when polymers LED of this invention has an electron transport layer

it carries out, a publicly known thing can be used, and they are an oxadiazole derivative and anthra quinodimethane.

or the derivative, benzoquinone or its derivative, and a naphthoquinone -- or

the derivative, anthraquinone or its derivative, tetracyano ANSURAKINOJI

ethane or its derivative, a fluorenone derivative, diphenyldicyanoethylene

r also the derivative, a diphenoquinone derivative, or 8-hydroxyquinoline

the metal complex of the derivative of \*\*\*\* to spread, polyquinoline or its derivative, poly

ynn or its derivative, Polyful Oren, or its derivative is illustrated.

\*\* etc. are illustrated.

[0231]

Polyquinoline is still more preferred.

[0232]

It is good.

[0233]

Ketone solvent, such as RUECHIRU ketone, ethyl acetate, butyl acetate, ethyl Cellosolve  
Ester solvent, such as acetate, is illustrated.

[0234]

The **\*\*\*\*\*** method can be used.

[0235]

RUMETAKURIRETO, polystyrene, polyvinyl chloride, or a polysiloxane

It \*\*\*\*\*.

[0236]

As thickness of an electron transport layer, an optimum value changes with materials to be used, and it is driver voltage.

Although what is necessary is just to choose so that luminous efficiency may serve as a moderate value, a pinhole is \*\* at least.

When thickness which does not carry out raw is required and not much thick, the driver voltage of an element is \*\*\*\*\* highly.

better -- there is no \*\*. Therefore, as thickness of this electron transport layer, it is 1 micrometer, for example from 1 nm.

It is, is 2 nm - 500 nm preferably, and is 5nm-200 still more preferably.

It is nm.

[0237]

The substrate which forms polymers LED of this invention forms an electrode, and is \*\* of this polymers LED.

It does not change, when forming a layer, and what is necessary is just glass and a plastic.

A high polymer film, a silicon substrate, etc. are illustrated. In the case of an opaque substrate, it is \*\*.

It is preferred that a pair of electrode is transparent or translucent.

[0238]

Usually, at least one side is transparent or translucent among the electrodes which consist of the anode and the negative pole.

It is and it is preferred that the anode side is transparent or translucent.

As a material of this anode, a conductive metal oxide film, a translucent metal thin film, etc. are used.

\*\*. Specifically, they are indium oxide, a zinc oxide, tin oxide, and those complexes.

It comes out and they are a certain indium tin oxide (ITO), and indium, zinc and OKISAI.

The films (NESA etc.) created using the electrically conductive glass which consists of DO etc., and gold, platinum

Silver, copper, etc. are used and they are ITO, indium, zinc and oxide, and tin-oxide \*\*\*\*.

better -- \*\*. As a manufacturing method, they are a vacuum deposition method, sputtering process, and Ion Preti.

The NGU method, plating, etc. are mentioned. moreover -- as this anode -- poly aniline -- or Organic transparent conducting films, such as the derivative, a polythiophene, or its derivative, are used.

\*\* is also good.

[0239]

Choosing suitably comes out of the thickness of the anode in consideration of the permeability of light, and electrical conductivity.

Although cut, it is 10 micrometers, for example from 10 nm, and is 20 nm - 1 micrometer preferably, and it is \*\*.

They are 50 nm - 500 nm preferably to \*\* and a pan.

[0240]

in order to make electric charge pouring easy on the anode -- a phthalocyanine derivative -- current is conducted

The layer which consists of sex polymers, carbon, etc. or a metallic oxide and metal fluoride, organicity

The layer of 2 nm or less of average thickness which consists of insulating materials etc. may be provided.

[0241]

A small material of a work function as a material of the negative pole used by polymers LED of this invention,

It is desirable. For example, lithium, sodium, potassium, a rubidium, caesium,

Beryllium, magnesium, calcium, strontium, barium, ALUMINIUM, a scandium, vanadium, zinc, yttrium, indium, cerium metal, such as samarium, europium, a terbium, and an ytterbium, -- and Among those, while those, they are [ two or more alloys or ] one or more, gold and silver, and platinum.

the inside of copper, manganese, titanium, cobalt, nickel, tungsten, and tin -- one -- with Upper alloy, graphite, or intercalated graphite etc. is used. Alloy

As an example of \*\*, they are a magnesium silver alloy, a magnesium indium alloy, and Magnesium.

A \*\*\*\*\*- aluminum alloy, an indium silver alloy, a lithium aluminum alloy

A lithium Magnesium alloy, a lithium indium alloy, calcium -\*\*\*\*\*

A minimum alloy etc. are mentioned. It is good also considering the negative pole as a laminated structure more than two-layer.

[0242]

Although the thickness of the negative pole can be suitably chosen in consideration of electrical conductivity or endurance

For example, from 10 nm, it is 10 micrometers, is 20 nm - 1 micrometer preferably, and is \*\*.

They are 50 nm - 500 nm preferably.

[0243]

As a manufacturing method of the negative pole, it is heat about a vacuum deposition method, sputtering process, and a metal thin film.

The laminating method etc. which are stuck by pressure are used. It is conductivity between the negative pole and an organic layer.

from [ organic insulating material / the layer which consists of polymers or a metallic oxide or metal fluoride, ]

The layer of 2 nm or less of \*\*\*\*\* thickness may be provided, and this polymers LED is protected after negative pole production.

It may equip with the protective layer to carry out. In order to use this polymers LED stably over a long period of time

In order to protect \*\* and an element from the exterior, it is \*\*\*\*\* about a protective layer and/or a protective cover.

\*\*\*\*\* is preferred.

[0244]

As this protective layer, they are a high molecular compound, a metallic oxide, metal fluoride, and metallic boride.

\*\*\*\* can be used. As a protective cover, it is \*\*\*\* to a glass plate and the surface.

The plastic sheet etc. which performed \*\*\*\* processing can be used and it is a thermal effect tree about this covering.

The method of pasting together to an element substrate and sealing by fat or photo-curing resin, is used suitably. SU

If space is maintained using a pacer, it is easy for an element to prevent that of crack \*\*\*\*.

.If inertness gas like nitrogen or argon is enclosed with this space, it will be \*\* about oxidation of the negative pole.

\*\*\*\*\* to stop is made and driers, such as barium oxide, are further installed in this space.

It is easy to control that the moisture to which it stuck by the manufacturing process more gives TAMEJI to an element.

It becomes. It is [ among these ] preferred to take any one or more policies.

[0245]

The polymers light emitting devices of this invention are a source of sheet-like light, a segment display, and dot MATRITSU.

It can use for the back light of a KUSU display or a liquid crystal display.

In order to obtain luminescence of surface state using polymers LED of this invention, it is the anode and the negative pole of surface state.

What is necessary is just to arrange so that it may suit in \*\*\*\*. In order to obtain luminescence

of pattern state,

The method, \*\* which install the mask which provided the window of pattern state in the surface of the light emitting device of said surface state

The method, the anode, or shade which forms the organic layer of a light-emitting part extremely thickly, and is substantially made nonluminescent

There is the method of forming the electrode of either of the poles or both in pattern state. This

A pattern is formed by one of methods and they are some electrodes independently On/OFF SE which can display a number, a character, an easy sign, etc. by arranging so that it can do A GUMENTO type display device is obtained. \*\* used as a dot-matrix element

If it arranges so that the anode and the negative pole may be formed in stripe shape and it may intersect perpendicularly with both \*\*

It is good. How to distinguish by different color the polymers photogen in which the luminescent color of two or more kinds differs with, and KARAFU

By the method of using IRUTA or a luminescence conversion filter, they are a partial colored presentation and Mull.

A CHIKARA display is attained. A dot-matrix element can also be driven passive.

It is and an active drive may be carried out combining TFT etc. Such display matter

Children are a computer, television, a personal digital assistant, a cellular phone, car navigation, and a bidet.

It can use as displays, such as a view finder of OKAMERA.

[0246]

The light emitting device of said surface state is a buckler of a liquid crystal display with a spontaneous light thin shape.

It can use conveniently as the source of sheet-like light for Ito, or a light source for lighting of surface state.

.If a flexible substrate is used, it will be used also as curved surface shape light source and display.

It can do.

[Example]

[0247]

Hereafter, in order to explain this invention still in detail, an example is shown, but this inventions are these.

It is alike and is not limited.

[0248]

Here, chloroform is used as a solvent about a number average molecular weight, and it is gel PAMIE.

The number average molecular weight of polystyrene conversion with - SHON chromatography (GPC)

\*\*\*\*\*.

[0249]

Example 1

<Manufacture of 2-(bromophenyl) pyridine>

3 g (19.3mmol) of 2-phenylpyridine, and 40 mg (0.716 m) of iron powder

mol was mixed and stirred. It is the bromine 4.0g (25 mm), cooling and stirring at 0 \*\*.

It was dropped noticing ol) about generation of heat, and to 90 \*\*, temperature up was carried out and it stirred for 10 hours. \*\*

After \*\*\*\*\*, this reaction mixed liquor is melted in chloroform, and is used as a solution, and it is 5% thiosulfuric acid NATO.

RIUMU solution washed. After drying chloroform fluid with sodium sulfate,

It condenses, silica gel column chromatography refines remnants, and it is 2 of the purpose. - (BUROMOFE)

Nil pyridine was obtained.

The yield was 1.6g (6.83mmol) and yield was 35.4%. LC-M

M<sup>+</sup> was 234.0 by S.

[0250]

<Manufacture of tris(2-(bromophenyl) pyridine) iridium (III)>

50 mg (0.1021 m) of tris acetylacetonato iridium (III) complexes

mol and 95.6 mg (0.4084mmol) of 2-bromophenylpyridine

And 20 ml of glycol was supplied to a 50-ml eggplant flask, and it flowed back for 10 hours.

.100 ml of 1-N hydrochloric acid aqueous solutions were added to this reaction mixture, and it stirred for 30 minutes. It deposits.

\*\*\*\*\* was filtered and taken, and it melted in the methylene chloride of a re-small quantity again, and was made the solution. this

Metal decomposition of the iridium complex origin which carried out silica gel column chromatography filtration of the solution, and remained

The thing was removed. Then, the obtained solution is condensed to the middle, methanol is added, and it deposits.

\*\*\*\*\* yellow solids were filtered and collected.

Tris(2-(bromophenyl) pyridine) iridium (III)1 which is an object

0.12 mg (0.0113mmol) was obtained. Yield was 11.1%. F

M<sup>+</sup> was 893 by D-MS.

[0251]

Example 2

< bis(2-(phenyl) pyridine)mono (2-(bromophenyl) pyridine)

Manufacture [ of iridium (III) ] >

Tris acetylacetonato iridium (III) complex 0.642g (1.31)

mmol and 0.41g (1.75mmol) of 2-(bromophenyl) pyridine

0.54g (3.5mmol) of 2-(phenyl) pyridine and glycol 5

0 ml was supplied to a 100-ml eggplant flask, and it flowed back for 10 hours. It is 1 to this reaction mixture.

100 ml of regulation hydrochloric acid aqueous solutions were added, and it stirred for 30 minutes. The depositing solid is filtered.

It took, it melted in the methylene chloride of a re-small quantity again, and was made the solution. It is silica gel about this solution.

Column chromatography filtration was carried out and the metal decomposition product of the surplus iridium complex origin was removed. \*\*

The yellow solid which condenses the obtained solution to the middle after \*\*, adds methanol, and deposits

It filtered and collected.

Bis(2-(phenyl) pyridine)mono (2-(bromophenyl) pyridine)

The mixture 0.13g (an equivalent for 0.177mmol) in which iridium (III) serves as the main ingredients

It obtained. Yield was about 13.5%. M<sup>+</sup> of the main ingredients is from FD-MS,

It was 733. This mixture is tris (2-(bromophenyl) pyridine).

An iridium (III) complex (complex 4), a mono(2-(phenyl) pyridine) screw

A 2-(bromophenyl) pyridiniridium (III) complex (complex 3), a screw

2-(phenyl) pyridinemono (2-(bromophenyl) pyridine) Ili Diu

A MU (III) complex (complex 2), tris(2-(phenyl) pyridine) iridium (I)

II) It is a mixture of a complex (complex 1). It asks for each ratio by FD-MS.

It was \*\* and as in the following table 1.

[0252]

[Table 1]

	ピーク比	組成比 (%)	備考
錯体 1	3 1	1 2 . 2	反応しないで系外へ排出される
錯体 2	8 6	3 3 . 7	分子の末端に反応する
錯体 3	1 0 0	3 9 . 2	
錯体 4	3 8	1 4 . 9	

[0253]

Example 3

&lt;Composition of the polymers photogen 1&gt;

0.403g (0.735 m) of 9,9-dioctyl- 2,7-dibromofluorenes

mol and 0.321g (0.7) of N-octyl-3,6-dibromocarbazole

Mono- [ 35mmol and / bis(2-(phenyl) pyridine)] (2- (bromo FENI))

\*\*) Pyridiniridium (III) 0.022g (0.03mmol: this combination)

Things are a tris(2-(bromophenyl) pyridine) iridium (III) complex and MONO.

(2-(phenyl) pyridine) Bis(2-(bromophenyl) pyridine)IRIJI

Mono- [ a UMU (III) complex, / bis(2-(phenyl) pyridine)] (2- (BUROMOFE))

A nil pyridiniridium (III) complex, tris (2-(phenyl) pyridine)

It is a mixture of an iridium (III) complex, preparation is faced, and it is a screw (2- (FU)).

ENIRU pyridinemono(2-(bromophenyl) pyridine) iridium (III)

the molecular weight 733 was used -- 0.55g (3.5 mm) of 2,2'-bipyridyls

After teaching ol) to a reaction vessel, nitrogen gas replaced the inside of the system of reaction. Oh [ this ]!

The tetrahydrofuran which carried out bubbling with Ecklonia argon gas, and was deaerated (dehydration solvent)

40 ml was added. Next, it is a screw (1,5-cyclo OKUTAJIE) to this mixed solution.

\*\*) Add 0.96g (3.5mmol) of nickel (0), and stir for 10 minutes at a room temperature.

After carrying out, it reacted at 60 \*\* for 8 hours. The reaction was performed in a nitrogen atmosphere. Reaction

10 ml of 25% ammonia solutions / methanol 150m after the back's cooling this solution

It poured into l / 50 ml of ion-exchange-water mixed solution, and stirred for about 30 minutes.

To the next

The generated precipitate was filtered and collected. After drying this precipitate, it dissolves in chloroform.

It carried out. After filtering this solution and removing an insoluble matter, it is graceful in methanol in this solution.

\*\*\*\*\* and the precipitate reprecipitated and generated were collected. Reduced pressure drying of this precipitate is carried out, and it is a polymer.

0.11 g was obtained. This polymer is called the polymers photogen 1.

[0254]

The polystyrene equivalent weight average molecular weight of the polymers photogen 1 is



$4.4 \times 10^{-5}$ .

The number average molecular weight was  $1.9 \times 10^{-5}$ .

[0255]

The polymers photogens 1 are a 9,9-dioctyl- 2,7-fluorene and N-octyl-  
-3,6-carbazole and tris (2-(phenyl) pyridine) Ili Diu

It is a copolymer which makes a MU (III) complex a repeating unit.

[0256]

Example 4

<Composition of the polymers photogen 2>

0.403g (0.735) of 9,9-dioctyl- 2,7-dibromofluorenes

mmol and a N,N'-diphenyl-N,N'-screw (3-methyl-4-bromo)

0.496 g (0.735mmol) of phenylbenzidine, and a screw (2- (FE))

Nil pyridinemono(2-(bromophenyl) pyridine) iridium (III)

0.022g (0.03mmol: this compound tris (2- (bromophenyl)))

An pyridiniridium (III) complex, a mono(2-(phenyl) pyridine) screw

(2-(bromophenyl) pyridine) An iridium (III) complex, a screw (2- (FU))

ENIRU pyridinemono(2-(bromophenyl) pyridine) iridium (III)

The mixture of a complex and a tris(2-(phenyl) pyridine) iridium (III) complex

Come out, it is, preparation is faced and it is [ mono- / (2- (BU)) / bis(2-(phenyl) pyridine)].

The molecular weight 733 of ROMOFENIRU pyridiniridium (III) was used. 2

\*\* after teaching 0.55 g (3.5mmol) of 2'-bipyridyls to a reaction vessel

Nitrogen gas replaced the inside of a \*\* system. Bubbling is beforehand carried out to this with  
argon gas.

\*\* and 40 ml of deaerated tetrahydrofurans (dehydration solvent) were added. Next, this \*\*

To \*\*\*, it is 0.96g about bis(1,5-cyclo-octadiene)nickel (0).

3.5 mmol, in addition, after stirring for 10 minutes at a room temperature, it reacted at 60 \*\* for  
8 hours.

The reaction was performed in a nitrogen atmosphere. 25% after cooling this solution after a  
reaction

150 ml of 10 ml of ammonia solutions / methanol / 50 ml of ion-exchange-water mixed solution

It flowed into inside and stirred for about 30 minutes. Next, the generated precipitate was filtered  
and collected.

After drying this precipitate, it dissolved in chloroform. This solution is filtered and it is an  
insoluble matter.

Precipitate which poured out this solution into methanol, and was reprecipitated and generated  
after removing

It collected. Reduced pressure drying of this precipitate was carried out, and the polymer 0.35g  
was obtained. It is quantity about this polymer.

It is called the molecule photogen 2.

[0257]

The polystyrene equivalent weight average molecular weight of the polymers photogen 2 is  
 $3.6 \times 10^{-5}$ .

The number average molecular weight was  $1.8 \times 10^{-4}$ .

[0258]

The polymers photogen 2 is 9,9-dioctyl- 2,7-fluorene, N, and N'-JI.

Phenyl-N,N'-bis(3-methylphenyl)benzidine and tris

\*\*\*\* which makes a 2-(phenyl) pyridiniridium (III) complex a repeating unit

It is union.

[0259]

Example 5

<Composition of the polymers photogen 3>

0.806g (1.47 m) of 9,9-dioctyl- 2,7-dibromofluorenes

Mono- [ mol and / bis(2-(phenyl) pyridine)] (2-(bromophenyl) PI)

Lysine iridium (III) 0.022g (0.03mmol: this compound TO)

Mono- [ a squirrel (2-(bromophenyl) pyridine) iridium (III) complex, ] (2-)

(Phenyl) Pyridinebis(2-(bromophenyl) pyridine)iridium

III) Mono- [ a complex, / bis(2-(phenyl) pyridine)] (2- (bromophenyl))

An pyridiniridium (III) complex, tris (2-(phenyl) pyridine) Ii

It is a mixture of a JIUMU (III) complex, preparation is faced, and it is a screw (2- (phenyl)).

The part of pyridinemono(2-(bromophenyl) pyridine) iridium (III)

The amount 733 of children was used. 0.55g (3.5mmol) of 2,2'-bipyridyls

After teaching a reaction vessel, nitrogen gas replaced the inside of the system of reaction. this -- beforehand

The tetrahydrofuran (dehydration solvent) 40 which carried out bubbling with argon gas and was deaerated

ml was added. Next, it is bis(1, 5-cyclo-octadiene)NI to this mixed solution.

After adding 0.96g (3.5mmol) of KKERU (0) and stirring for 10 minutes at a room temperature

It reacted at 60 \*\* for 8 hours. The reaction was performed in a nitrogen atmosphere. After a reaction, \*\*

150 ml of 10 ml of 25% ammonia solutions / methanol / I after cooling \*\*\*\*\*

It poured into 50 ml of one exchange water mixed solution, and stirred for about 30 minutes.

Next, it generates.

\*\*\*\*\*s were filtered and collected. After drying this precipitate, it dissolved in chloroform.

It is a pour lump in methanol about this solution after filtering this solution and removing an insoluble matter.

It reprecipitated and the generated precipitate was collected. Reduced pressure drying of this precipitate is carried out, and it is the polymer 0.1.

1 g was obtained. This polymer is called the polymers photogen 3.

The polystyrene equivalent weight average molecular weight of the polymers photogen 3 is  $7.6 \times 10^4$ ,

The number average molecular weight was  $1.2 \times 10^4$ .

[0260]

The polymers photogens 3 are a 9,9-dioctyl- 2,7-fluorene and tris.

\*\*\*\* which makes a 2-(phenyl) pyridiniridium (III) complex a repeating unit

It is union.

[0261]

Example 6

<Polymers LED>

To the glass substrate which attached the ITO film by a thickness of 150 nm by the sputtering technique, it is poly (ECHIRENJI).

It is business about the solution (a Beyer company, Baytron) of a oxythiophene / polystyrene sulfonate.

It is, membranes are formed by a thickness of 50 nm with a spin coat, and it is 120 \*\* on a hot plate, and is for 5 minutes.

It dried. Next, the 0.5wt% chloroform fluid of the polymers photogen 1 is used, and it is SUPINKO.

Membranes were formed by a thickness of about 70 nm by TO. This was dried at 80 \*\* under decompression for 1 hour.

It is 0.4 nm about lithium fluoride as after and a cathode buffer layer, and is KARUSHIU as the negative pole.

Subsequently 25 nm of aluminum [ 40 nm of ] was vapor-deposited for MU, and polymers LED was created. Vacuum evaporation

All the degrees of vacuum at the time were  $1 - 8 \times 10^{-6}$  Torr(s). Voltage is marked on the obtained element.

\*\*\*\*\* -- the EL luminescence from the polymers photogen 1 was obtained by things. Intensity

of EL luminescence

It was proportional to \*\*\*\*\* mostly.

[0262]

Example 6

<The calculation example of intersystem crossing>

Structure of at least 3-fold paragraph excitation state of a tris (2-phenylpyridine) iridium complex

By the B3LYP method, it asked using the LANL2MB basis function. About the structure, it is further.

By the TDDFT method of a B3 LYP/LANL2MB level, it is a letter of at least 3-fold [ at least 1-fold paragraph excitation state-] paragraph excitation.

It was 0.87 eV when the energy difference between voice was searched for. In calculation, it is Gaussian98 PU.

Log rum was used.